POTENTIAL FUNDING MECHANISMS FOR IMPLEMENTATION OF REMEDIAL ACTION PLANS AND THEIR IMPACT ON USERS, BENEFICIARIES, POLLUTERS AND SOCIETY

NOVEMBER 1992

Ontario

Environment
Environnement

ISBN 0-7778-0224-4

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Cette publication technique
n'est disponible qu'en anglais.

PIBS 2138

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Report prepared for:

The Ontario Ministry of the Environment

Report prepared by:

Hickling Corporation
Division of Economics and Policy

In association with:

R.V. Anderson Limited
and
Resource Futures International (RFI), Inc.

OCTOBER 1992

PIBS 2138

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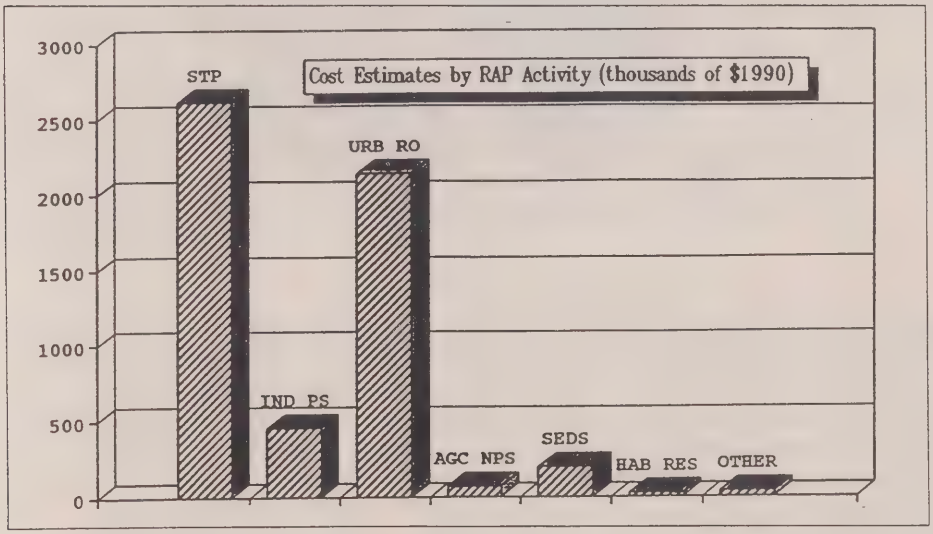
EXECUTIVE SUMMARY

Under the Great Lakes Water Quality Agreement, Remedial Action Plans (RAPs) are required for 17 areas of concern on the Canadian side of the Great Lakes. These RAPs are in various stages of development but all identify known sources of aquatic pollution, propose measures necessary to control these existing sources and abate environmental contamination in order to restore beneficial uses.

Updated cost estimates[1] have been prepared for the 17 RAP sites for remedial actions related to sewage treatment plants, industrial point source, urban runoff, agricultural non-point source, sediments and habitat restoration. These new cost estimates show that:

- Capital costs are estimated to be $5.5 billion (an increase of 272% over 1990);
- 86% of costs relate to STP upgrades and Urban Runoff controls;
- 56% of costs relate to Metro Toronto.

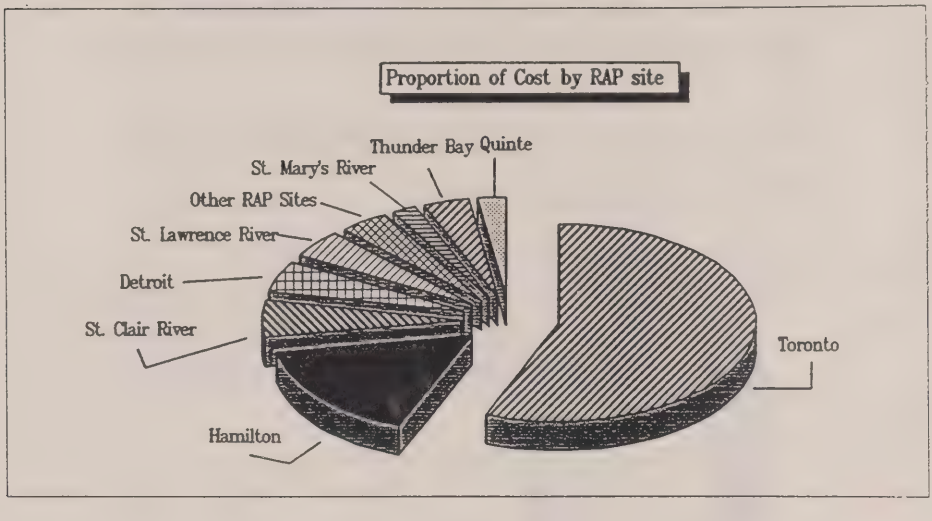
Figure 1-1: Capital Cost Estimates - Proportion by RAP Activity



[1] The costs presented in this report are based on the best information available at the time the analysis was undertaken. It is understood that these costs will need to be continually updated as the RAPs are developed and new costs determined based on the selection of priority remedial actions.

The high cost of remediation and the potential shortfall in the levels of funding available from traditional sources suggests that, even with the introduction of innovative, alternative funding mechanisms, there will be a need to develop a method for maximising the efficient allocation of available financial resources. An appropriate tool in this respect is cost-effectiveness analysis which can be used to ensure that the desired effects of remediation are achieved at the lowest possible costs. The problem at the present time is there is much uncertainty about both the effects and costs of remediation. In order illustrate how quantification and uncertainty can be considered in the allocation of scarce resources a Risk Analysis Process was applied to an example from the Toronto RAP of combined sewer overflow. This example shows how to determine the most cost-effective level for a single type of remediation activity as well as for different mixes of remediations.

Figure 1-2: Capital Cost Estimates - Proportion by RAP site



There are important jurisdictional issues relevant to the implementation of RAPs. All three levels of government have some jurisdiction over water quality. At the federal level the Canadian Environmental Protection Act (1988) represents a move into areas previously regarded as provincial. The federal government also controls the protection and conservation of fisheries, has authority over navigation and shipping and has equivalent legislative authority with the provinces for agriculture. In international agreements related to water quality while the federal government has the authority to make such agreements their implementation relies on the provinces. The provinces, as owners of public resources, are both water managers and policy makers. The Ontario Water Resources Act, Environmental Protection Act and Municipal Industrial Strategy for Abatement (MISA) are all examples of specific legislation and programs undertaken by the province in the area of water quality. Municipalities provide major services to the public, such as storm and sanitary sewerage treatment, which directly impinge on water quality.

The result of this jurisdictional situation has been the development of federal-provincial agreements related to water quality such as the Canada Ontario Agreement Respecting Great Lakes Water Quality and the Canada Ontario Memorandum of Intent on the Management of Habitat.

The existing sources of funding available from federal and provincial levels of government to address the concerns at the RAP sites are inadequate to meet the current cost estimates for remediation. Municipal funding for STP upgrades and Urban Runoff controls may offset this inadequacy. However, full implementation of RAPs will still require the development of alternative financing mechanisms to cover these costs. Excluding municipal funding and assuming that current provincial and federal programs are focussed on RAP activities:

- Annualized costs are estimated to be $650 million; and,
- Average Annual Funding is estimated to be $310 million.

Internationally, the trend in the use of financing mechanisms to provide sources of funding for environment-related projects has been moving away from traditional mechanisms based on the general budget (e.g., general income taxes, grants) and in the direction of charges on specific groups of users, beneficiaries or polluters. While user charges for water and household solid waste are currently in use in Canada, a large proportion of environmental programs are funded by subsidies or grants. In turn, most of these grants are funded by the general budget (i.e., taxes).

The economic evaluation of alternatives suggests that the RAP financing framework should include a system of appropriately based charges. Such charges would fully recover costs from responsible parties (polluters, users or beneficiaries) according to either the costs they impose on the environmental resource, or the benefits they derive from it. Such a framework for RAP financing will be more economically efficient and equitable than existing financing mechanisms.

The most appropriate way of testing some of these alternative financing mechanisms would be through the development of case studies for existing RAP sites. A comprehensive case study approach would examine and compare the cost allocation principles in terms of seven criteria: identification and bounding of user groups; nature of allocable costs; funding mechanism feasibility; implementation and administrative cost; market impacts; social impacts; cost-effectiveness. In the limited case study approach undertaken in the present study several cases were developed for the Toronto, Hamilton and Bay of Quinte RAP areas.

These case studies are designed to indicate how various stakeholders would be affected under certain RAP funding scenarios, and to assess the feasibility of such scenarios. In particular estimates of incremental impacts are presented in terms of:

- Cost per representative stakeholders; and,
- Additional charges per unit of pollution/use/benefit.

Funding scenarios which have been examined included:

•	User-Pay:	Sewage treatment/CSO
•	Polluter-Pay:	Industrial Point Source, Agricultural Non-Point Source, Sediment Removal
•	Beneficiary-Pay:	Habitat Restoration, Sediment Removal, Agricultural Non-Point Source

Key results of the case studies are as follows.

- **STP/CSO.** Estimated total annual costs are $378.4 million for Toronto, $76.3 million for Hamilton and $8.8 million for Quinte. Under the user-pay-principle and including a provincial contribution equal to 33 percent of capital costs, the corresponding incremental costs per household are $241, $287 and $133, respectively.

- **Agricultural Non-Point Source Control.** Estimated total annual costs are $2.6 million for Quinte. This implies annual incremental costs of $2,871 per farm, or $10 per acre of farmland under a polluter-pay regime. Allocating cost according to the beneficiary-pay principle implies an additional charge of either $42 per day of recreational use or $52 per household.

- **Industrial Point Source Control**. Estimated total annual costs are $38.2 million for Hamilton. Assuming that these are borne entirely by Stelco and Dofasco, the annual cost per cubic meter of industrial effluent is $1.96.

- **Sediment Removal.** Estimated total annual costs are $17.6 million for Hamilton. This implies a cost of $0.90 per cubic meter of industrial effluent under a polluter-pay regime. Allocating costs according to the beneficiary-pay principle implies an additional charge of either $117 per day of recreational use or $86 per household.

- **Habitat Restoration.** Estimated total annual costs are $0.1 million for Toronto and $1.6 million for Hamilton. This implies a cost of $10 per day of recreation use in the case of Hamilton under a beneficiary-pay regime. Annual cost per household is negligible for each of Toronto and Hamilton.

1.0 INTRODUCTION

This is the final report of the major findings of the study of potential funding mechanisms for Remedial Action Plans, and their impact upon users, polluters, beneficiaries, and society.

The updates of the costs associated with the RAPs for the 17 areas of concern are provided in Chapter 2.0 of the report. Chapter 3.0 provides an approach to the examination of the cost effectiveness of the remedial activities and combination of activities and utilizes the Toronto RAP to illustrate this approach. Chapter 4.0 discusses the jurisdictional issues related to federal, provincial and municipal responsibilities for the expected RAP implementation activities. Chapter 5.0 provides a summary of the existing federal and provincial programs which are relevant to the implementation of RAPs. Chapter 6.0 provides an assessment of the adequacy of current funding programs to finance the RAPs, comparing estimated costs of RAP actions with existing federal, provincial, and municipal funding. Chapter 7.0 provides an international review of alternative and innovative funding mechanisms which could be used to finance RAP implementation activities. Chapter 8.0 outlines a comprehensive approach toward the implementation of the case studies. Chapter 9.0 is a report on the limited implementation of this case study approach, focusing on the incremental effects on identified users, polluters, and beneficiaries.

In Annex A we provide an annotated bibliography based on a literature review of the key international documents available on innovative alternatives for funding RAPs. Annex B provides an inventory of existing federal and provincial programs that could be used for RAP funding purposes. Annex C provides detailed calculations for cost estimates contained in Chapter 2.0. Annex D contains an original copy of the RAP Coordinator Questionnaire. Finally, Annex E contains a complete bibliography of all literature sources examined for this study.

2.0 COST UPDATES

2.1 INTRODUCTION

Under the Great Lakes Water Quality Agreement (1987) Remedial Action Plans (RAPs) are required for 17 areas of concern on the Canadian side of the Great Lakes. These RAPs are in various stages of development, but all address undesirable aquatic pollution problems and the known sources of pollution, including sewage treatment plant discharges, urban and agricultural runoff, industrial discharges.

Cost estimates for the required remedial works were prepared as part of an overview economic assessment issued in April 1990[1]. R.V. Anderson Associates Limited, in association with HICKLING Corporation, were requested to update these cost estimates for the purpose of evaluating alternative financing schemes.

2.2 BACKGROUND INFORMATION

The primary source of information was the April 1990 report entitled "Overview Economic Assessment of Remedial Action Plans for the Great Lakes Areas of Concern" prepared by Apogee Research International. The document provided estimates of the orders of magnitude of costs for restoring the beneficial uses at the 17 Areas of Concern that were covered by Remedial Action Plans.

The costs in this 1990 report were reviewed and updated as fully as possible, based upon current studies and reports (some currently in preparation) and discussion with several investigators active in the field. Key components of the RAPs, such as sewage treatment plants costs and urban runoff, were examined by specialist engineers and different estimating methods were also applied. In other less well-defined remedial activities, such as sediments removal, discussions were held with principal investigators familiar with the individual sites.

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[1] Apogee Research International Ltd, Overview Economic Assessment of Remedial Action Plans for the Great Lake's Areas of Concerns, Ontario Ministry of the Environment, April 1990.

2.3 COSTING METHODOLOGY

2.3.1 1990 Apogee Report

The costing method applied in the 1990 Apogee report can be summarized as follows:

- The remedial actions required to achieve the four water quality objectives were identified for each of the 17 sites, in conjunction with the RAP representatives. RAP coordinators were asked to provide information on the estimated cost of remedial actions.

- In cases where cost information was not available from the RAP teams, the study team used a variety of technical sources, both Canadian and U.S., to estimate the remedial costs using appropriate estimating formulae or regressions.

- There were some cases in which no cost estimates could be obtained, either from the RAP teams or from the technical literature and experts. The removal of dioxins from pulp and paper effluent is the most significant example of this situation. When appropriate, this fact is noted on the results reported for the RAP sites. A complete list of pollution sources which were not costed at each site was included in the 1990 Apogee report.

Figure 2-1 summarizes the maximum costs (ie. costs for each remedial activity contained in all water quality objectives) from the 1990 report. Some elements, such as urban runoff control, were included in water quality objectives of some sites but not others. Figure 2-1 includes all of the remedial measures mentioned at a site.

A number of important observations can be made from this table. Firstly, 3 categories of remedial measures, sewage treatment plant upgrading, industrial point sources, and urban runoff, represent the major proportion of the overall costs. The other elements are small in comparison.

Secondly, there are some significant gaps in the estimates that are not apparent in reading the detailed estimates contained in the 1990 report. For example, no industrial point source estimates are provided for Metro Toronto. Agricultural runoff costs are not included for areas where these sources may be expected to be important, such as Niagara and Detroit River.

2.3.2 Current Cost Estimates

The approach taken to determine 1991 cost estimates in the current report varies with the type of remedial activity and the sources of updated information available. In general, the approach taken was as follows:

1. Develop new procedures to estimate costs for the most expensive remedial actions: STP upgrades and Urban Runoff controls.

2. Update cost estimates for all six categories of remedial actions where current information is available (i.e. Hamilton Harbour and Collingwood Harbour).

Hamilton Harbour estimates represent the maxima of the cost ranges presented in "The Remedial Action Plan for Hamilton Harbour" (December 1991). The estimates for Collingwood Harbour are taken from "A Delisting Strategy for Collingwood Harbour: A Preferred Options Position Paper" (September 1991).

3. Update estimates for other remedial activities (i.e. industrial point source, agricultural non-point source, sediment removal, and other remedial actions) at the remaining fifteen areas of concern are updated from the 1990 Apogee report for inflation only.

Current cost estimates are for capital (or one-time) costs only. Annual operating and maintenance costs may be significant in some cases. The 1990 Apogee report estimated annual operating and maintenance expenses to be in the range of $150 million.

2.4 COST CATEGORIES

2.4.1 Sewage Treatment Plant Upgrades

The costs for sewage treatment plant upgrading were reviewed on a site by site basis. Based upon our knowledge of each plant, new capital costs were estimated for the level of treatment indicated in the 1990 report. In the cases of Niagara Falls and Fort Erie, the 1990 report indicated these are primary facilities, whereas at present they are secondary plants. Our new costs reflect this.

For Metro Toronto, treatment plant costs were not presented in the 1990 report. Therefore, we incorporated costs from the current Metro Toronto RAP report, which contains considerable detail regarding upgrading works.

An ongoing review of Provincial water programs by the Ministry of the Environment indicates that the costs for STP upgrades may be lower than the estimates presented in this report, particularly for Metro Toronto.

2.4.2 Industrial Point Source Controls

With regard to Industrial Point Source Controls, very little information was available for review, with the exception of the Hamilton RAP. For all sites, except Hamilton, the 1990 costs were updated to account for inflation only.

MOE recognizes that the cost estimates for industrial point source controls are likely understated. It is possible that costs for industrial point source controls may eventually exceed costs to municipalities for pollution control. However, since industrial polluters are expected to finance their own abatement activities it was deemed unnecessary to provide further updates to these estimates at this time.

Figure 2-1: RAP Sites - Apogee Report Cost Estimates

FIGURE 2.1: RAP SITES - COST ESTIMATES ($1990 million)

SITE	STP	IND PS	URB RO	AGC NPS	SEDS	WTP	MIT ACT	TOTAL
Collingwood	0.04		2	3				$5.04
Detroit	52	2	28					$82.00
Hamilton	59	39	65	0.5	2		6	$171.50
Jackfish Bay			0.4					$0.40
Niagara	35	8	67					$110.00
Nipigon	1.8		0.5					$2.30
Peninsula Harbour	0.2							$0.20
Port Hope					6			$6.00
Quinte	12	5	14	39		0.7	12.8	$83.50
Severn Sound	0.2		5		2			$7.20
Spanish River	5							$5.00
St. Clair River	29	143	11	6				$189.00
St. Lawrence River	23	2	9	8				$42.00
St. Mary's River	29	7	12					$48.00
Thunder Bay	33		17		33			$83.00
Toronto			600	26				$626.00
Wheatley Harbour		0.09						$0.09
TOTAL	**$279.24**	**$206.09**	**$830.90**	**$82.50**	**$43.00**	**$.7**	**$18.80**	**$1,461.23**

Note: All figures shown are in millions of dollars.

Source: Apogee Research International Ltd., et al, "Overview Economic Assessment of Remedial Action Plans for the Great Lakes' Area of Concern", Prepared for the Ministry of the Environment, Queen's Printer, April 1990.

2.4.3 Urban Runoff Control

In the 1990 report, urban runoff costs were estimated by means of a stormwater utility approach, in which runoff control and treatment costs were estimated from assumed annual per capita revenues for a typical utility. We decided to review these costs by developing approximate engineering costs, on a per hectare basis, and then using these to update the urban runoff costs for each site.

The following procedure was applied.

a. Unit costs for storage and treatment of urban runoff and combined sewer overflows were estimated for a typical catchment.

b. Urban drainage areas (storm and combined) were obtained by literature search and by map measurement for each of the 17 RAP sites.

c. Capital costs were estimated for each RAP site and summarized. Annex C contains the estimating assumptions used in the process. While still representing order of magnitude estimates, we felt that this provided a reasonable assessment for Canadian municipalities. Figure 2-2 contains a tabulation of urban drainage areas taken from the literature and checked by our staff with map measurements.

d. The cost estimation procedure for urban runoff differentiated between combined sewer areas, densely developed areas with older infrastructure and high remedial costs, and separate stormwater areas in existing suburban and newly developing neighbourhoods. A lower unit cost for stormwater control was applied uniformly to both developed and undeveloped areas, based upon actual areas listed (storm and combined) in municipal documents for each urban area, cross checked with approximate map measurements and discussions with the municipalities involved. Large undeveloped and unserviced areas in some municipalities were not included in the costs. Four of the smaller RAP sites, involving less than 400 hectares of serviced area, were not costed for urban runoff control because of their small size and the fact that stormwater was not identified as an issue.

During this process we contacted other study teams working in the field, one[2] of which is working to develop CSO control costs for each of the 17 RAP Sites. Accordingly, some coordination and liaison took place between our study teams. Any new material from this source should be incorporated into future cost estimates when it becomes available.

The major differences in cost estimates between the 1990 Apogee report and this document are due to different estimating procedures, and due to the fact that some gaps in the data base existed. For example, in Port Hope, no urban runoff measures were previously identified, whereas we felt that since an extensive stormwater drainage system does serve this town, some

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[2] Personal Communication, Mr. G. Zukovs, CH2M Hill, Toronto.

urban runoff control costs should be included.[3] The largest difference in the cost estimates, accounting for the bulk of the $3.7 billion increase was due to STP upgrading and urban drainage controls for the Toronto RAP site. Both of these were relatively small in the previous documentation, but in the interim, new RAP documents have been prepared.

Our urban runoff estimating methodology was based upon containing and treating 5 mm of runoff from each catchment. While no official policy exists with regard to the level of control required (this is usually set from site-specific studies), it is clear that total costs will increase almost exponentially as the amount of runoff handled is increased. To capture and treat all runoff events would be prohibitively expensive, and dealing with 75-90% of the events might be a reasonable criterion.

2.4.4 Sediments

These costs were originally developed to deal with problems related to contaminated sediments at known "hotspots", as well as toxic chemicals from hazardous waste disposal sites.

Very little information was available in the background documents. Updated estimates for the Hamilton RAP have recently become available, and these are presented below in Figure 2-3. All other available costs from the 1990 report have simply been updated to account for inflation.

2.4.5 Agricultural Non-Point Source

For all RAP sites, other than Bay of Quinte, estimates of the cost of agricultural non-point source remediation were based on corresponding data from the Apogee report. These values have been inflated to 1990 dollars. Estimates for Quinte represent conservation tillage capital costs only. Estimates of these costs per hectare were taken from the Bay of Quinte RAP Coordinating Committee's discussion paper "A Time to Decide". Costs per hectare were ten multiplied by the estimated number of hectare under cultivation to yield an estimate of total capital costs.

2.4.6 Habitat Restoration

Habitat restoration primarily involves fisheries rehabilitation and development. Costs in this category were taken from "Fisheries Rehabilitation and Development: Report of the Canada/Ontario Memorandum of Intent on the Management of Fish Habitat, Working Group No. 4., June 1990." The exception to this are the costs for Nipigon ($3 million over 4 years) that were supplied by the Nipigon RAP coordinator.

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[3] For the town of Port Hope, urban runoff control costs were based upon 624 ha of urban area at $25,000 per hectare for stormwater control. This includes drainage from the town but not from the upstream watershed of the Ganaraska river. Although no stormwater control costs were listed for Port Hope in the original documents received, such costs were included to be consistent with other RAP sites, since local urban runoff obviously reaches the harbour. Currently, the Port Hope RAP does not specifically include the town, therefore these costs may be overstated.

FIGURE 2.2: STORM AND COMBINED DRAINAGE AREAS AT RAP SITES

SITE	POP	COMB (Ha)	STORM (Ha)
Collingwood	12,196	70	398
Detroit	202,173	1,055	2,351
Hamilton	327,800	6,150	1,938
Jackfish Bay			370
Niagara	253,569	954	936
Nipigon	1,393		370
Peninsula Harbour			370
Port Hope	10,243		624
Quinte	125,931	646	1,252
Severn Sound	16,610	140	1,264
Spanish River	5,358		370
St. Clair River	48,664	814	2,317
St. Lawrence River	45,529	858	858
St. Mary's River	78,568		1,656
Thunder Bay	124,386	432	1,298
Toronto	4,267,118	11,754	28,074
Wheatley Harbour			370

2.4.7 Other Remedial Actions

Costs for water treatment plant improvements were based upon treatment of filter backwash residue at only one site, Quinte. This was a very small cost, almost negligible in comparison with other remedial measures.

Under the category of Other Remedial Actions here again the only significant cost was for a scheme to circulate and flush fresh Lake Ontario water into the Bay of Quinte. While this may be technically feasible, it is difficult to envisage such a measure, entailing relatively high capital and operating costs, being constructed. For both of these categories, previous costs were simply updated to account for inflation.

2.5 SUMMARY

Figure 2-3 contains the results of our capital cost updating for all 17 RAP Sites. Significant increases are due mainly to the costs for STP upgrading and Urban Runoff Control, which represent about 90% of the total RAP Costs. Both of these cost categories were updated to reflect current information and new estimating methodologies. However, since cost estimates are continually being updated, figures listed here may not coincide with estimates derived since 1991.

Controlling urban runoff, including both storm drainage systems and combined sewer systems, will be an expensive proposition. Source control can be most easily incorporated in new developments. For the RAP sites considered, however, existing heavily developed areas are involved. There is no doubt that extensive and costly capital works will be necessary to reduce the related pollution discharges.

2.6 RAP COORDINATOR QUESTIONNAIRE STATUS REPORT

In order to check the accuracy of identified remedial activities and their estimated cost, all Ontario RAP Coordinators were faxed a questionnaire requesting brief information for use in this project. The questionnaire had been reviewed by the project steering committee prior to sending. On May 10, 1991 all RAP Coordinators with responses still outstanding were sent a second request for information.

The original questionnaire is provided in Annex D.

FIGURE 2.3: RAP SITES - COST ESTIMATES IN 1990 $ ($million)

SITE	STP (1)	IND PS	URB RO (2)	AGC NPS	SEDS	HAB RES	Other Remedial Actions	TOTAL
Collingwood (5)	18.41	21.62				2.44	0.30	$42.77
Detroit	170.80	2.30	111.50			0.11		$284.71
Hamilton (3)	173.15	240.00	295.00		150.00	17.50	18.00	$893.65
Jackfish Bay						0.10		$0.10
Niagara	20.00	9.20	71.00					$100.20
Nipigon	1.92					3.0		$4.92
Peninsula Harbour	1.00					0.12		$1.12
Port Hope			15.60		6.90			$22.50
Quinte	22.20	6.00	63.60	22.00		0.36	14.70	$128.86
Severn Sound	7.50		38.60		2.30	0.57		$48.97
Spanish River	4.48					0.07		$4.55
St. Clair River	70.50	165.00	98.60	6.90				$341.00
St. Lawrence River	169.80	2.30	64.40	9.20		1.21		$246.91
St. Mary's River	58.90	8.10	41.40			0.12		$108.52
Thunder Bay	116.70		54.00		38.00	0.26		$208.96
Toronto (4)	1783.00		1289.00	29.90		1.27		$3,103.17
Wheatley Harbour		0.10						$0.10
TOTAL	$2,618.36	$454.62	$2,142.70	$68.00	$197.20	$24.22	$33.00	$5,541.10

(1) STP cost estimates to secondary treatment standards

(2) $50,000/ha for combined areas and $25,000/ha for storm areas.

(3) The source of these figures is the draft paper "The Remedial Action Plan for Hamilton Harbour", December, 1991. Since growth-related costs are not identified in this draft document, this component of costs is included in the estimates given here.
Note: These figures are the maxima of cost ranges presented in this document, and are expressed in 1991 dollars.
IND PS for Hamilton are estimated MISA program costs

(4) STP/WTP figures do not include $400 million in growth-related costs, based upon the 1991 Metro Works department 10 year capital forecast.

(5) Estimates for Collingwood are as identified in 'A De-listing Strategy for Collingwood Harbour: A Preferred Options Position Paper' (Sept. 1991).

(6) In all cases, these cost figures include only capital costs.

(7) Nipigon HAB RES costs are as per costs supplied by Nipigon RAP coordinator, all other HAB RES costs as per Report on MOI Working Group no. 4 (June 1990).

3.0 A FRAMEWORK FOR COST-EFFECTIVENESS ANALYSIS

3.1 INTRODUCTION

Remedial Action Plans involve the expenditure of funds to achieve positive effects on water quality and the aquatic environment. Ideally, the value to society of the beneficial effects achieved by each mutually exclusive remedial step will exceed the cost to society of taking that action. A value-cost comparison will account for the fact that people prefer benefits now rather than later. Prospective remedial actions will thus be viewed over a long time period; future (life-cycle) costs and effects will be "discounted" to reflect their value to the community today and only those actions whose net present-day value is positive will be undertaken.

However, whereas the costs of possible remedial actions can be counted in dollars and cents, the social and economic value of their effects are difficult to estimate. An alternative is to measure effects in physical rather than monetary units (e.g. reduction in the quantity of diluted industrial waste or increase in the perceived amenity of beach-front) and compare these effects with the discounted life-cycle costs of achieving them. This is the essence of cost-effectiveness analysis.

In cost-effectiveness analysis the ideal is to ensure that desired effects (i.e. standards) are achieved at the lowest possible cost or that as high a remedial standard is achieved for a given level of expenditure. In reality, however, "correct" standards are difficult or impossible to gauge. And expenditure levels, rather than being fixed, will vary depending upon the promise of what can be achieved. Indeed, to be useful, a cost-effectiveness framework should help determine reasonable budget levels by revealing clean-up standards that make sense in light of the costs and benefits of achieving them.

Under ideal conditions, cost-effectiveness analysis builds upon known relationships and linkages between actions and impacts, costs and effects. In actual fact, there is considerable uncertainty about the relationships between options for remedial action and their effects on various aspects of water quality and the aquatic environment. To be useful, a cost-effectiveness framework needs to recognize these uncertainties and reveal their implications in the assessment of alternative remedial actions. Presenting decision- makers with an unrealistic sense of certainty is a hinderance to good policy. Still, allowing uncertainty to present obstacles to quantification is no less a barrier to good decision making. A useful cost-effectiveness framework needs to both promote quantification and cope with uncertainty.

3.2 THE FRAMEWORK IN PRINCIPLE

The Risk Analysis Process is a cost-effectiveness framework that offers the ability to reveal cost-effective remedial actions and spending levels and the flexibility to accommodate uncertainty in the process of doing so. The major advantage of the framework is that it immediately brings the analysis further to the level where one simply discusses and describes the likely impacts of remedial measures. While these important steps should be part of any serious analysis, the framework goes beyond by allowing projects to be interdependent (or mutually exclusive), explicitly introducing uncertainty, etc. Figure 3-1 to Figure 3-2 illustrate the basic principles. Consider the (simplified) objective of reducing the contaminant loadings in a river basin. Figure 3-1 charts the probability that a $100 million investment in a sewer separation program will reduce the contaminant loadings by certain amounts.

As the illustration shows, there is a virtual 100 percent probability of reducing contaminant loadings by at least 10 percent as a result of the program and a very small chance of doing better than 90 percent. The median (50 percent) expectation indicates that the investment would reduce contaminant loadings by some 50 percent or more--a median cost-effectiveness ratio of some $2 million per percentage point reduction. A 25 percent probability of achieving a ratio in excess of $1.43 million per percentage point reduction can also be discerned (i.e. the probability of reducing loadings by more than 70 percent is 25 percent and $100 million divided by 70 is $1.43 million).

3.2.1 Comparing Alternative Expenditure Levels

Figure 3-3 looks at two levels of investment in sewer separation, the $100 million option from Figure 3-1 and a $50 million alternative. Which of the two is "superior"? At the median level of probability, the $50 million alternative is expected to achieve in excess of a 40 percent reduction in contaminant loadings while the $100 million option is expected to exceed a 50 percent reduction. This means that the $50 million alternative is likely to be more cost-effective in the sense that each percentage point reduction costs $1.25 million, versus $2 million in the $100 million option. There is however a 20 percent chance that the $100 million option will prove as cost-effective as the $50 million alternative (i.e. it has a 20 percent chance of reducing contaminant loadings by more than 80 percent, and $100 million divided by 80 is $1.25 million).

If, however, environmental standards dictate that contaminant loadings should be reduced by at least 80 percent, then the $100 million option is more appropriate since there are substantially higher odds of achieving the target relative to the $50 million alternative. This finding would, of course, prompt the search for the most cost-effective technology to achieve the target. This process is illustrated in Figure 3-4.

Figure 3-1: Probability of $100 Million Investment

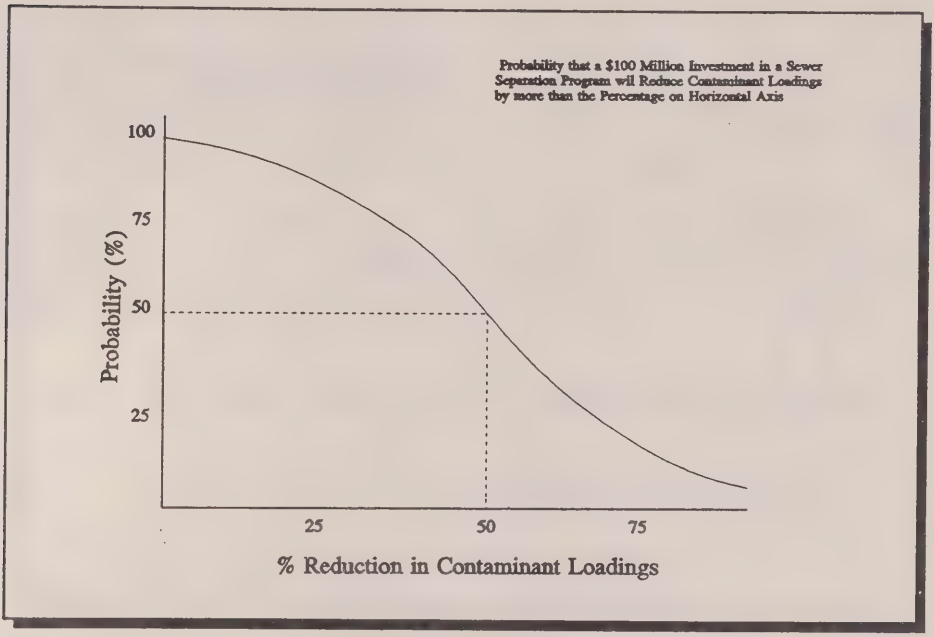
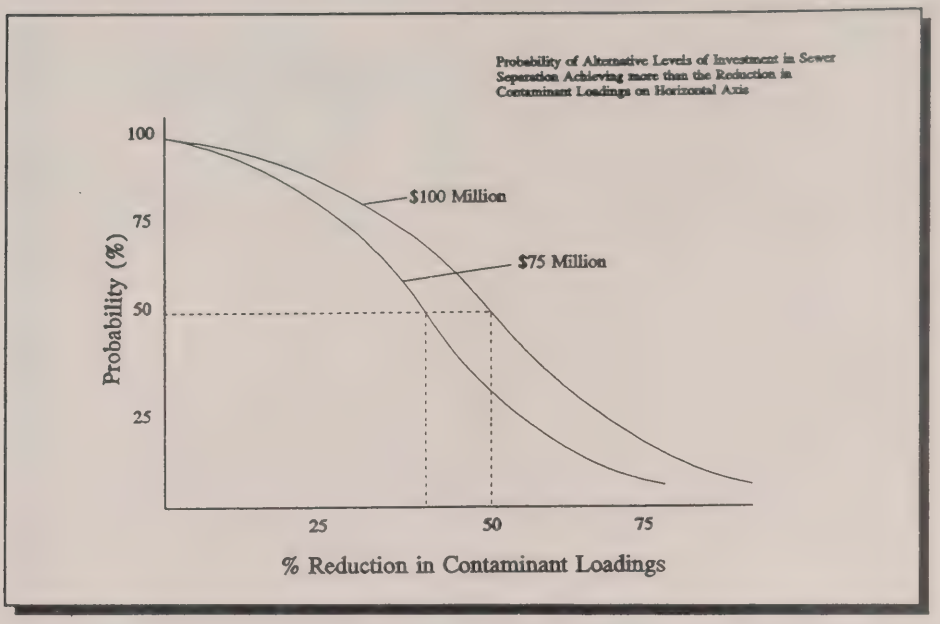


Figure 3-2: Probability of Alternative Investment Mixes



3.2.2 Comparing Alternative Technologies

In Figure 3-4, the $100 million approach (a sewer separation program) is compared with an alternative technology which carries a price tag of $75 million. Both are seen to offer very similar odds of achieving the 80 percent reduction target. The $75 million alternative may thus be said to be potentially more cost-effective. On the other hand, the analysis in Figure 3-4 reveals that the lower cost technology is also more risky in the sense that it offers lower median expectations. In other words, the $75 million technology offers a 50 percent chance of exceeding a 40 percent reduction against the $100 million option which offers a median expectation in excess of 50 percent. The $75 million technology is somewhat more cost-effective at this level however, since it costs $1.88 million per percentage point reduction versus a $2 million ratio in the $100 million case. On balance, the $75 million alternative appears superior, indicating an expected reduction in contaminant loadings of 40 percent and a 20 percent chance of achieving the desired 80 percent standard.

3.2.3 Comparing Alternative Program Mixes

Figure 3-2 illustrates the framework in the context of alternative remedial investment mixes. Most remedial action plans involve an "ecosystem approach" in which various actions, some mutually dependent and others mutually exclusive, are combined into a total program. The

cost-effectiveness question turns on which of several alternative program mixes offers the greatest environmental benefits (contaminant reductions) at the least cost per unit.

The example in Figure 3-2 is illustrative of a situation in which a lower cost investment mix achieves a lower level of remediation (less reduction in contaminant loadings) but at a more cost-effective rate of spending. On the other hand, the higher cost technology offers higher odds of substantially greater remediation, but at an incremental cost of $250 million. The framework thus reveals risks, opportunities and trade-offs that the decision-maker must then resolve in relation to budgetary and policy priorities.

It should be noted in relation to Figure 3-2 that virtually any "intent" variable can be represented on the horizontal axis and replace the "% reduction in contaminant loadings". As shown below, this includes broad objectives such as cleaner, better sport fisheries and intangibles such as improved beach-front amenity.

Figure 3-3: Probability of Alternative Levels of Investment in Sewer Separation

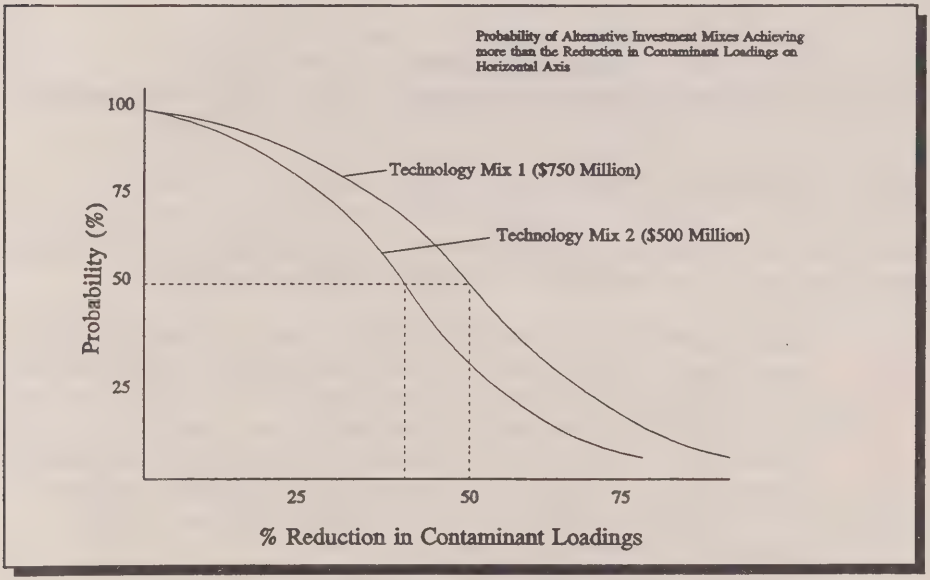
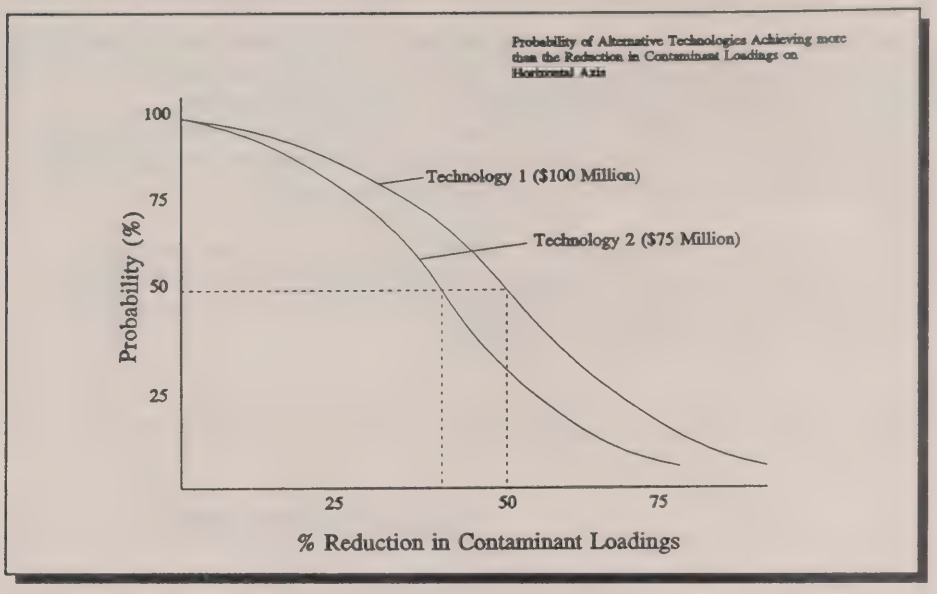


Figure 3-4: Probability of Alternative Technologies



3.3 THE FRAMEWORK IN PRACTICE

In practice, the Risk Analysis Process framework yields cost-effectiveness analysis like that illustrated in the previous section on the basis of a six step process, as follows:

1. **Identification of a Remediation Goal.** The choice of a Remediation Goal determines the units with which the effectiveness of the alternative programs is measured. Combined Sewer Overflow (CSO), for example, is known to be responsible for the introduction of bacteria, nutrients and other chemicals into the water system. Habitat Restoration, on the other hand, may have no impact whatsoever on the level of bacteria. Including Habitat Restoration in a cost-effectiveness analysis that has a goal of reducing fecal coliform bacteria levels clearly makes little sense.

   In selecting a remediation goal, the ease with which the effectiveness of the program can be isolated, should be considered. In general, the choice of the Remediation Goal can be made by the RAP Coordinator with consultation from the Public Advisory Committee and the Technical Advisory Committee.

2. **Identification of Remedial Activities and Investment Packages to be Subject to Cost-Effectiveness Analysis.** Although the cost-effectiveness analysis often reveals new opportunities and investment packages, a well-reasoned span of alternatives is important at the start of the process.[1] All Remedial Activities that are not mutually exclusive and that are thought to have some impact (no matter how small) on the Remedial Goal selected in the first step should be included. In the case of Remedial Activities (or options within Activities) that are not mutually exclusive, a number of alternative packages must be designed to ensure that all logical alternatives are considered.

   The selection of the Remedial Activities and Investment Packages should be done by the RAP Coordinator after consultation with experts (scientists, engineers, lawyers etc.). In the case of some RAP sites (e.g., Metro Toronto), Remedial Activities have already been surveyed and the identification process will be relatively straightforward. For those RAP sites that are not this far advanced, the identification of Remedial Activities and Options will have to proceed before this step can be completed.

3. **Develop Structure and Logic Models.** The structure and logic model lies at the heart of the Risk Analysis Process. A structure and logic model depicts all the variables that are thought to influence a particular remedial objective and the relationships between the variables. An example of a structure and logic diagram is presented in Figure 3-5. This figure illustrates the impact of illegal sanitary sewer connections on the reduction of bacteria levels. The variables illustrated combine in a mathematical formula to produce a solution to the *Annual Reduction in Fecal Coliform Levels due to Sanitary Sewer Cross Connection Remediation.*

   The mathematical equation represented in this example diagram is:

$$\begin{aligned} RFC &= NTD * AFC \\ &= [API * NTI * EMT] * [NCC * TFC] \\ &= [API * NTI * EMT] * [NCC * (PCC * TBL)] \end{aligned}$$

   where:

RFC	Annual Reduction in Fecal Coliform Levels due to Sanitary Sewer Cross Connection Remediation
NTD	Annual Number of Cross Connections Traced and Disconnected
AFC	Average Fecal Coliform Bacteria Count per Connection
API	Average Productivity of Trained Inspectors
NTI	Number of Trained Inspectors

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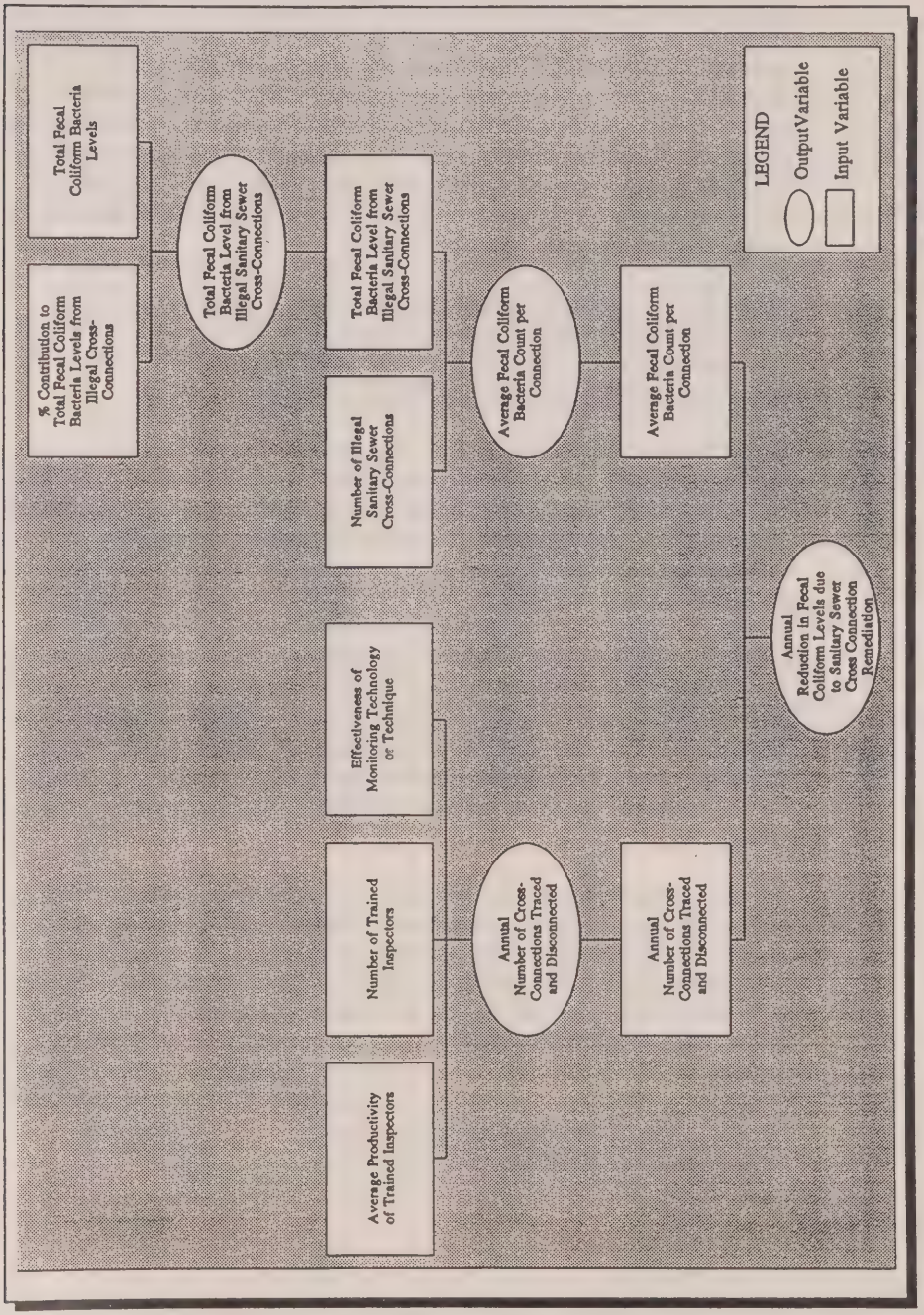
[1] The current practice of constructing "Benefit and Impact" matrices for preliminary screening of alternatives is perfectly acceptable at the initial stage. However, these matrices are by no means sufficient to carry out cost-effectiveness analysis.

EMT	Effectiveness of Monitoring Technique
NCC	Number of Illegal Sanitary Sewer Cross Connections
TFC	Total Fecal Coliform Level from Illegal Cross Connections
PCC	% Contribution to Total Bacteria Level from Illegal Cross Connections
TBL	Total Fecal Coliform Bacteria Level

In this example, the only operator used is multiplication. This is purely coincidental since any mathematical operator could potentially be used in a structure and logic model.

It is important to note that it is by no means necessary to have a definitive scientific basis for specifying variables or their interrelationships. Indeed, the Risk Analysis Process is specifically designed for situations in which such considerations are uncertain. What is needed is the best scientific evidence brought to bear in a systematic and logical representation of the process in question. Once the variables have been explicitly declared in the Structure and Logic diagrams, the information requirements for the cost-effectiveness analysis are revealed. Once complete, the structure and logic model is incorporated into the Risk Analysis Process.

Figure 3-5: Example of Structure and Logic Model



4. **Initial Estimates and Probability Distributions.** Each variable and interrelationship specified in the structure and logic model is assigned a numerical estimate and a range to represent the degree of uncertainty in the estimate. Using special "data sheets" (see Figure 3-6), the range actually represents an "80 percent confidence interval"--the range within which experts feel roughly 80 percent confident of finding the actual outcome. The greater the uncertainty about a variable or assumption, the wider the range will be, and vice versa. If scientific data are available, it is of course brought to bear. Where evidence is scant, expert judgement is used and ranges of uncertainty are necessarily wider.

5. **Broad Expert Scrutiny.** Whereas the initial estimates and probability ranges will be developed by a small group, the Risk Analysis Process which outside experts are brought together to scrutinize the estimates and ranges and to change them in order to achieve consensus.

6. **Cost-Effectiveness Analysis.** The Risk Analysis Process incorporates the structure and logic model into a cost-effectiveness program and translates the ranges developed above into statistical probability distributions. Probability distributions of cost-effectiveness are then "simulated" by allowing the estimates for all variables in the structure and logic model to vary according to their assigned probability ranges. This process (called Monte Carlo simulation) is repeated a sufficiently large number of times in order to generate a valid probability range for cost-effectiveness.

   In general, the cost-effectiveness of an option is expressed as a ratio of the total cost of the Remedial Option, Activity or Investment Package to the effectiveness in addressing the environmental goal. With the use of Monte Carlo simulation, however, a probability distribution is generated of the cost-effectiveness.

   To rank the alternatives under consideration, the level of certainty (from a probability standpoint) must be selected. The selection of the probability level is a policy decision that must be made by the RAP Coordinator in consultation with the Committees advising the process. Because of the high level of uncertainty inherent in the variables affecting the costs and/or effectiveness of the RAP program, however, it may be more appropriate to examine the 90th percentile. Once a decision has been reached on the level of certainty, the alternative with the lowest cost-effectiveness ratio should be selected. This is illustrated in Figure 3-7 where it is 90% certain that Alternative B has the lowest cost-effectiveness ratio.

Figure 3-6: Example of a Data Sheet

EFFECTIVENESS OF MONITORING TECHNOLOGY/TECHNIQUE
(Expressed as a Percentage)

DESCRIPTION

A multi-year factor that is multiplied by the *Number of Trained Inspectors* and the *Average Productivity of Trained Inspectors* to determine an estimate of the *Annual Number of Cross Connections Traced and Disconnected*. This factor reflects both the technical and jurisdictional difficulties in ensuring that an illegal storm sewer connection is detected.

HOW THE VARIABLE EFFECTS THE REDUCTION IN FECAL COLIFORM LEVELS

Factors of less than 100 percent will lead to a lower success rate in the detection of illegal connections, resulting in higher fecal coliform levels than could be achieved with ideal monitoring technology and techniques.

BASELINE ASSUMPTIONS

Sampling and other techniques already in use have proved relatively successful in tracing sources of illegal connections. If the storm sewer does not contain infiltration water, however, the waste will reside in the sewer until the next storm. In addition, grab sampling and wire basket straining techniques have limited with many occupants away during the day when the testing occurs. As a result, an initial estimate of 85 percent has been assumed for 1990. It should be noted that this estimate relies on anecdotal evidence only, since there are no scientific studies that provide quantitative data.

MAJOR UNCERTAINTIES

The lack of firm study in this area creates substantial uncertainty in the estimate. Qualitative evidence suggests that there is a greater chance that this initial estimate will be low and this is reflected in the lower bound. The uncertainty surrounding this estimate suggests that even wider ranges for the upper and lower bound could be chosen -- the panel is asked to comment.

UPPER AND LOWER 10% LIMITS

As indicated above, a lower 10% limit of 72 percent was selected for 1990 to reflect the possibility that current monitoring technology and techniques may provide "false negative" results. An upper 10% limit of 89 percent was selected.

Figure 3-7: Hypothetical Example of Cost-Effectiveness Results for Reduction in Fecal Coliform Levels at different levels of uncertainty

Alternative	Cost-Effectiveness ($/Reduction in Bacteria Levels)		
	10th Percentile	50th Percentile	90th Percentile
A	0.42	0.86	1.21
B	0.22	0.47	0.90
C	0.30	0.48	0.98

In the next section, the cost-effectiveness framework will be illustrated using data from the Metro Toronto Remedial Action Plan.

3.4 APPLICATION OF COST-EFFECTIVENESS FRAMEWORK TO TORONTO RAP

This section will demonstrate an example application of the Framework using the Metro Toronto Remedial Action Plan. The example presented here will explore the cost-effectiveness analysis of the different options within one remedial intent. As will be demonstrated, the analysis presented can be easily extended to the cost-effectiveness of remedial intents or other investment "mixes".

It should be noted from the outset that the analysis presented in this chapter is to be treated as an example only. Actual data from the Metro Toronto RAP has been used to the extent possible augmented with hypothetical estimates. An actual cost-effectiveness analysis requires rigorous study of cost and effectiveness data, access to expert panellists and the use of specialized software to generate results -- all of which are beyond the scope of the present study.

The Cost-Effectiveness Framework presented in the previous chapter was composed of the following six steps:

1. Identification of a Remediation Goal;

2. Identification of Remedial Activities and Investment Packages to be Subject to Cost-Effectiveness Analysis;

3. Develop Structure and Logic Models;

4. Initial Estimates and Probability Distributions;

5. Broad Expert Scrutiny; and

6. Cost-Effectiveness Analysis.

In what follows, each of the six steps will be discussed in the context of the Metro Toronto RAP.

3.5 IDENTIFICATION OF A REMEDIATION GOAL

The choice of a specific remediation goal must be made before the cost-effectiveness analysis can proceed -- in general, any goal can be selected. Bacteriological Contamination is identified as one of the primary environmental problems for the Metro Toronto Area of Concern.[2] The goal that will be used in this chapter, therefore, will be the reduction of fecal coliform bacteria levels. With this remediation goal in place, the effectiveness portion of the cost-effectiveness equation will turn on its ability to reduce fecal coliform bacteria levels.

3.6 IDENTIFICATION OF REMEDIAL OPTIONS AND INVESTMENT PACKAGES TO BE SUBJECT TO COST-EFFECTIVENESS ANALYSIS

The Metro Toronto Remedial Action Plan has been subjected to a high level of research and has well-defined remedial options. As a result, this step is relatively easier than it would be in the absence of such research. The official documents of the Metro Toronto RAP identify a total of seven remedial intents, each with a number of components.[3] For the purposes of this example, Remedial Intent #2 *Reduce the Impact of Treated and Untreated Sanitary Sewage*, will be selected.

Remedial Intent #2 contains the following components:

2.1.1 Main Sewage Treatment Plant Improvements
2.1.2 Humber Sewage Treatment Plant Improvements
2.1.3 Highland Creek Sewage Treatment Plant Improvements
2.1.4 North Toronto Sewage Treatment Plant Improvements
2.2.1 Virtual Elimination of Combined Sewage Overflow
2.2.2 Illegal Sanitary Connections
2.2.3 Sewer Use By-Laws

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2 *Metro Toronto Remedial Action Plan: Environmental Conditions and Problem Definition*, September 1988, page iii.

3 Metro Toronto Remedial Action Plan, *Draft Discussion Paper on Remedial Options*, 1990.

The first four components deal with sewage treatment plant improvements while the latter three address the discharge from storm sewer outfalls and overflow points, and controls on sewer use.

3.7 DEVELOP STRUCTURE AND LOGIC MODELS

With all of the alternative options defined, the next step is to explicitly define the two sides of the cost-effectiveness equation in structure and logic models. This was already done in the previous chapter (albeit hypothetically) for the effectiveness portion of Component Action 2.2.2 *Illegal Sanitary Connections*. On the cost side, engineers, contractors and other experts must be consulted to determine the variables that will effect the final cost of the Remedial Option. The cost of delisting existing priority outfalls for the Metro Toronto RAP, for example, depends on the number of cross connections per outfall and the cost per cross connection.[4] This is illustrated in Figure 3-8.

The process of constructing structure and logic diagrams must be completed for both the cost and effectiveness portions of each component being compared. The structure and logic diagrams that result from this step are accompanied by a detailed prose critique and analysis of the model. The Diagram and detailed critique thus permit accurate and detailed visual inspection of the model and all its structural and logical attributes. The Structure and Logic Model thus permits inspection of a model by experts who may not be readily able to comment on the merits of a model by inspecting it only in its mathematical or statistical form.

3.8 INITIAL ESTIMATES AND PROBABILITY DISTRIBUTIONS

In this step, each of the variables, parameters and coefficients that make up the structure and logic diagrams developed in the previous step will be assigned an initial numerical estimate. In our example of the Metro Toronto Remedial Action Plan, sufficient information exists to make this a relatively straightforward exercise. For example, the capital and operation and maintenance costs of improvements to sludge incineration at the Humber Sewage Treatment Plant (Remedial Action 2.1.2) have already been estimated but may require updating.[5] Other estimates may be more difficult to obtain due to a lack of data. In these cases, experts will be consulted to provide "guesstimates" as initial numerical values.

At the same time that the initial estimates are being developed, the uncertainty associated with each estimate is also gauged. Some of the numerical estimates will be known with relative certainty and this will be reflected in the range of uncertainty. Others, such as the costs of tracing illegal sewer connections (Remedial Action 2.2.2), will be relatively more uncertain and will require a wider 80 percent confidence interval.

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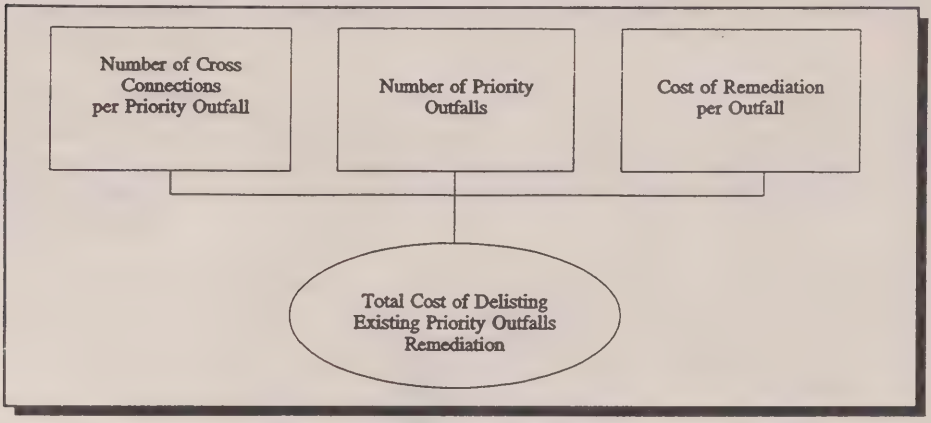
[4] Metro Toronto Remedial Action Plan, *Op. Cit.*, p. 2-56.

[5] Metro Toronto Remedial Action Plan, *Draft Discussion Paper on Remedial Options*, 1990, pg. 2-6.

Figure 3-8: Total Cost of Delisting Existing Priority Outfalls



The result is a series of data sheets, one for each variable, which gives the initial estimate of the numerical value of the variable and the uncertainty which is given by an 80% confidence interval. A description that gives the data, methodology and rationale used to derive the numerical value are provided along with the potential sources of uncertainty. All that is needed is the identification of the three points specified in the data sheets to find the probability distribution for these points. This is illustrated in Figure 3-9 using the data presented in the example data sheet in Figure 3-7, Alternative A.

3.9 BROAD EXPERT SCRUTINY

In this step, a panel of outside experts is formed in order to;

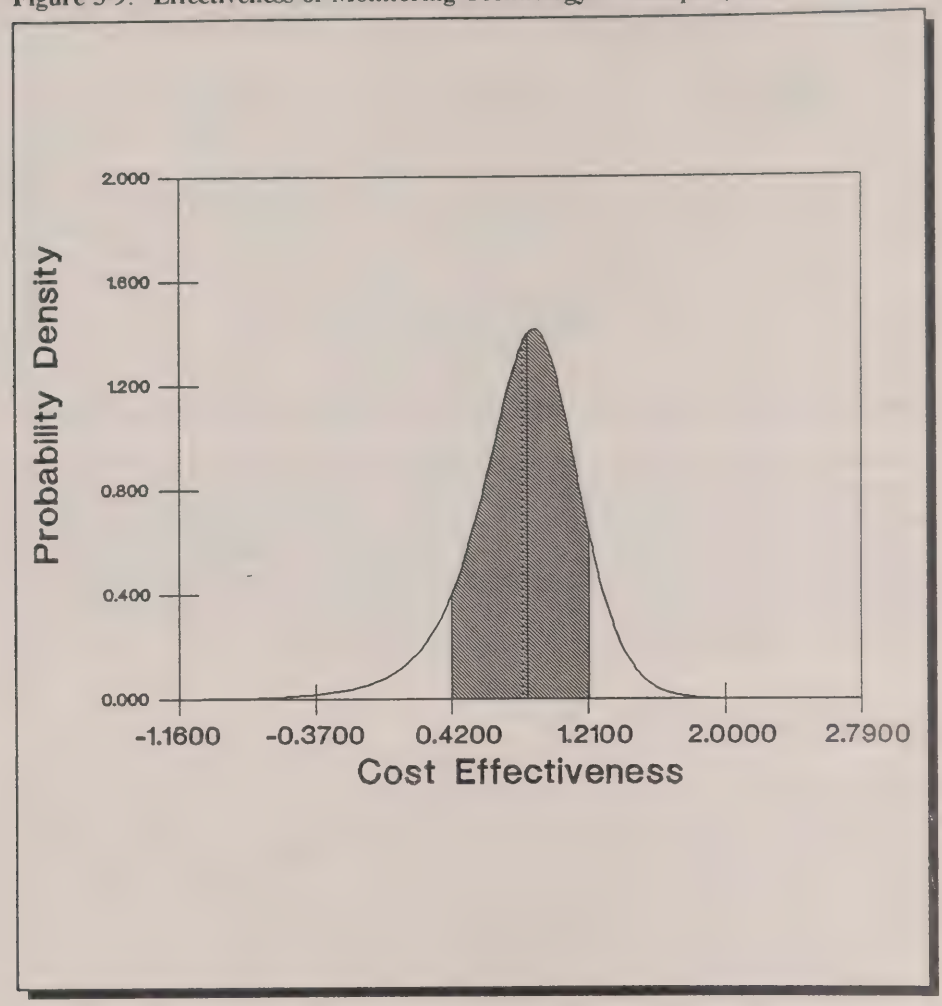
(i) Scrutinize and critique the models, using the Structure and Logic Diagrams as referenced; and

(ii) Scrutinize the estimates and probability ranges, using the data sheets as reference.

The review of the data sheets can be an iterative process. The results of the first round of changes are then reviewed by the panel to refine the estimates and probability ranges even further.

For example, the number of cross connections per priority outfall from Figure 3-8 was initially estimated at three. After several rounds with experts in the area, the most likely estimate may have been modified to be 4.5. Once consensus has been achieved, the models and the data sheets can be finalized for input into the Risk Analysis Process. At this stage, there will be 14 logic and structure models (two for each Remedial Option alternative) and one data sheet for each variable from the models.

Figure 3-9: Effectiveness of Monitoring Technology/Technique (1990)



3.10 COST-EFFECTIVENESS ANALYSIS

Figure 3-10 presents hypothetical results for the effectiveness Remedial Action 2.2.1. The graph indicates that there is an eighty percent chance that the reduction in fecal coliform bacteria levels will lie between 56.00 and 98.00 organisms per millilitre.

Figure 3-11 shows what a table of cost effectiveness results might look for the example from Metro Toronto. The most cost effective remedial action (in this hypothetical example) is 2.1.1, *Main Sewage Treatment Plant Improvements* (true at both the 50th and 90th percentile). There is a small probability, however, that Remedial Action 2.2.1 is the most

cost effective option (revealed at the 10th percentile). With the high degree of uncertainty associated with environmental projects, the 90th percentile is chosen as the common frame of reference for ranking.

A similar analysis can be performed to determine the cost effectiveness of any number of components, remedial intents or investment mixes. As indicated in the previous chapter, the framework is sufficiently robust to tackle a number of different aggregations of options. As more information and data becomes available, the results will become more refined and easier to interpret.

Uncertainty in both the effectiveness and the costs of environmental remediation make the framework ideally suited for the evaluation of RAP options. Any uncertainty is explicitly dealt with in the process, allowing officials to build consensus among interested parties. The procedure requires only a minimal understanding of statistics, leaving experts free to concentrate on providing the most accurate inputs possible.

Figure 3-10: Reduction in Fecal Coliform Bacteria Levels (Weighted Average)

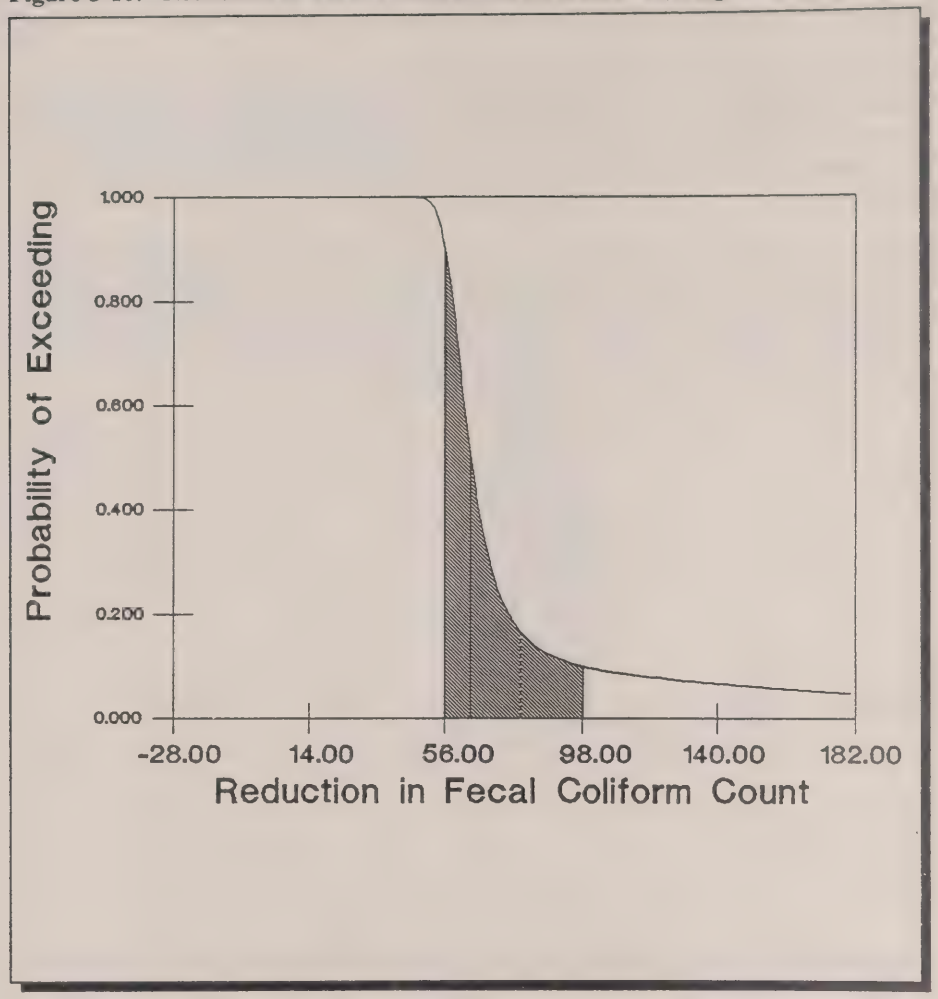


Figure 3-11: Hypothetical Cost Effectiveness Results for Remedial Intent #2 for Different Levels of Uncertainty.

Remedial Action Alternative	Cost Effectiveness ($/Reduction in Bacterial Levels)		
	10th Percentile	50th Percentile	90th Percentile
2.1.1	0.81	1.21	1.89
2.1.2	0.83	1.34	1.95
2.1.3	0.91	1.54	2.35
2.1.4	0.89	1.45	2.03
2.2.1	0.67	1.65	2.96
2.2.2	1.85	3.98	10.25
2.2.3	2.55	4.51	11.37

4.0 JURISDICTIONAL ISSUES

4.1 INTRODUCTION/BACKGROUND

The Constitution Act of 1867 (the "constitution") does not mention water. It does deal with some water uses, such as navigation, fisheries, and more recently, electrical energy generation. However, water quality management and jurisdiction are in a state of flux as they undergo a process of rapid evolution, particularly in light of current constitutional discussions. It is clear, however, that the provinces currently have wide jurisdiction over water, having assumed control of natural resources within provincial boundaries.[1] The provinces are the primary policy-makers and are responsible for implementation of water management decisions, a number of which are made in the context of international agreements made by the federal government.

What follows is a discussion of jurisdictional issues as they pertain to water resource management in the Great Lakes region. Jurisdictions are described under three categories: federal, provincial, and municipal. Included in the discussion are descriptions of jurisdictional issues arising from potentially overlapping authorities.

4.2 FEDERAL POWERS

The Federal government's legislative authority in the area of water and water quality derive from its responsibilities for navigation, shipping and for sea coast and inland fisheries. The federal government also has criminal law powers which would include, for example, the right to prosecute individuals and corporate entities for causing bodily harm to those affected by water contaminants. Finally, Section 91 of the Constitution Act, provides the federal authority to legislate for the peace, order and good government of Canada on any matter not exclusively assigned to the provinces. A variety of research programs are conducted under this program; they are generally welcomed by the provinces as they do not threaten provincial sovereignty.

Use of federal residual powers to regulate or legislate (the basis under which interprovincial disputes are to be settled), are seen to be appropriate under two different scenarios. The first provides for federal jurisdiction over specific subjects that have emerged since 1867 that are of national interest (e.g. Aviation and atomic energy). The second scenario is where federal jurisdiction is required due to a situation having reached the dimensions of a national emergency, something justifying temporary assumption of authority pending solution of an

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[1] Pearse, P.H., Bertrand, F., and Maclaren, J.W.. Currents of Change. Final Report: Inquiry on Federal Water Policy (1985).

issue.[2] While it serves as a means of widening the scope of federal government operations, its use can jeopardise harmonious federal-provincial government relations.[3]

4.2.1 General

The Canadian Environmental Protection Act (CEPA, 1988) represents a move into environmental protection territory that was previously regarded as mainly provincial. To avoid costly duplication of provincial efforts, the federal government has adopted the practice of "equivalency," where CEPA regulations would be drawn back and not apply in provinces where it was agreed that provincial laws are equivalent.

CEPA will allow the Minister of the Environment to compel polluters to clean up controlled chemicals released into the environment. The government is given new authority to inspect, take samples and seize chemicals to ensure compliance with the new legislation. The government also gains power to temporarily halt any action which might result in chemical pollution of the environment.[4]

4.2.2 Fisheries

While the provinces possess the proprietary rights to their fish as they do for water, the federal government controls the protection and conservation of fisheries. Under the Fisheries Act, no one is permitted to disturb fish habitat except with the Minister's approval. The act also makes it an offense to deposit any "deleterious substance of any type in water frequented by fish." These powers may directly constrain other uses of watercourses. The federal government, for example, can regulate local works and undertakings to ensure the maintenance of fish passage and to protect spawning, rearing and other habitat areas from physical disturbance and pollution detrimental to fish.[5]

Jurisdictional Issues:

- Jurisdiction is complicated here due to overlapping responsibilities for fisheries. The courts have responded to this conflict by ruling that federal powers are limited to the regulation and protection of fish, and prohibit federal regulation of activities (such as fishing) that would prejudice the provinces' rights as owners.

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2 Pearse, P.H., Bertrand, F., and Maclaren, J.W.. Currents of Change. Final Report: Inquiry on Federal Water Policy (1985).

3 Grover, Brian, and David Zussman. Safeguarding Canadian Drinking Waters. Inquiry on Federal Water Policy (1985).

4 Environment Canada. Overview of the Canadian Environmental Protection Act (1989).

5 Pearse, P.H., Bertrand, F., and Maclaren, J.W., *op cit.*

- Prohibition against depositing deleterious substances is very rigid, making it almost impossible for any waste discharges to conform to the letter of this law, or for the law to be enforced consistently.

4.2.3 Navigation

Section 91(10) gives the federal government exclusive legislative authority over navigation and shipping. It controls the design and construction of any structure that might interfere with navigation, regulate the deposit of material that could interfere with navigation, and define waste disposal restrictions for ships and shipping facilities.[6]

Jurisdictional Issue:

- The courts have adopted a generous definition of navigability, requiring federal approval for significant projects even on small rivers. Intervention under this authority must be justifiable on the specific grounds that it protects navigation.[7]

4.2.4 Agriculture

The constitution permits both federal and provincial governments to legislate with respect to agriculture, but it provides that federal legislation will prevail in the case of a conflict.

Jurisdictional Issue:

- Unilateral federal legislation of this kind threatens to encroach on provincial authority over property, so most water projects are carried out by agreement with the provinces.[8]

4.2.5 Federal Powers over Interjurisdictional Waters

As Canadian waters become more intensively used and plans proceed for further developments, impacts on downstream provinces have grown in importance. The Constitution is silent on the specific issue of federal powers dealing with such interprovincial issues. However there appear to be some residual powers that the federal government could bring to bear, such as exercising its jurisdiction over works within a province by declaring them to be for the general advantage of Canada or of two or more provinces. While the power is there, it has rarely been used.[9]

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6 *ibid*, pg. 4.

7 *ibid*, pg. 13.

8 ibid, pg. 18.

9 *ibid*, pg. 4.

Jurisdictional Issues:

- Such intervention would represent the imposition of one province's pollution control requirements over another province's, effectively superseding the jurisdiction of the latter province to legislate over its internal waters. Crucial to this question is whether the tort in this case (pollution of downstream waters) is legally considered to have been committed in the jurisdiction in which the act took place or in the jurisdiction where the harm was suffered.

- Any attempt by the Federal government to assert power to regulate water flows or quality at interprovincial boundaries would be met with strong opposition from the provinces, unless an issue of national emergency were involved. The reason for provincial opposition is that federal controls at border points could have far reaching effects on a province's powers to manage its water far upstream from its border. The nature of the Canada Water Act recognizes these potential issues and indicates a federal unwillingness to attempt to assert regulatory powers over interprovincial waters except in the unlikely event of national emergencies.[10]

4.3 INTERNATIONAL JURISDICTIONS

The federal government has all the powers necessary to fulfil Canada's obligations arising from international treaties made while Canada was part of the British Empire. Two treaties are of importance here. Under the Boundary Waters Treaty (1909), the federal government can take the steps necessary to protect open and free navigation and the maintenance of natural levels and flows of boundary waters, those waters that flow along or are part of the Canada-U.S. border, but excluding tributaries. The treaty also commits both parties to prevent pollution of both boundary waters and waters flowing across the boundary "to the injury of health or property" in the other jurisdiction. This power would extend to the Great Lakes, part of the St. Lawrence and several major watercourse crossing or part of the border such as the Okanagan, Columbia, Souris, Saint John, and the St. Croix.[11]

4.3.1 International Joint Commission Powers

The International Joint Commission (IJC) was established in Article VI of the Boundary Waters Treaty (1909). Articles III and I give the IJC its quasi-judicial function. Article III requires IJC approval for unilaterally-implemented works causing obstructions or diversions of boundary waters affecting the natural level or flow of boundary waters. Navigation improvements not materially affecting the level or flow on the opposite side of the river, and ordinary use of

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[10] ibid, pg. 4.

[11] ibid, pg. 4

boundary water are exempted. Article I extends the IJC approval requirement to obstructions downstream of the boundary that raise the natural level of waters at the boundary.[12]

Jurisdictional Issues:

- Canada's federal structure constrains the federal government in bilateral relations. The American system gives its federal government a leading role in environmental issues, while in Canada the provinces own and have responsibility of husbanding their natural resources. The lack of legally enforceable federal water pollution limits has created problems in Canada's dealing with the U.S. regarding the Great Lakes. Lacking a federal framework of legally enforceable standards comparable to that which exists in the U.S., the federal government and departments dealing in water quality issues cannot directly implement programs to meet signed treaty and agreement objectives and obligations undertaken with the U.S. regarding Great Lakes water quality.[13]

- A large number of jurisdictions and agencies of two national governments, eight states and one province are involved in aspects of the Great Lakes ecosystem management. Drawing the pieces together into a cohesive coordinated force to produce effective solutions is a difficult task, with the IJC playing a key role. The IJC, however, does not have powers to require the implementation of remedial action plans.

- The federal role has been shifting to a greater concentration on pollution control technology development and transfer, as well as an advocacy role. The federal role in implementing the Canada/Us GLWQA is primarily one of research, surveillance, and the provision of funds to Ontario. Implementation is primarily the responsibility of the Province. Until CEPA, only a few substances, such as PCBs, came under federal regulatory control, while more than 800 substances that have been identified in the Great Lakes, many of which may be toxic.

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12 LeMarquand, David. Boundary Water Relations and Great Lakes Issues. Inquiry on Federal Water Policy (1985).

13 ibid, pg. 5.

4.4 PROVINCIAL JURISDICTION

Section 109 of the Constitution bestows the ownership of public resources to the provinces. This has been interpreted to include the proprietary rights to rivers and other watercourses, excepting those waters occurring on federal lands within the provinces. The provinces regulate the rights to use them within their respective territories, except for those rights that by common law are public rights, namely the right to navigate in virtually all waters and the right to fish in tidal waters.[14]

The provinces, therefore, are both water managers and policy-makers. They can determine policy for water apportionment, and regulate its quality to meet provincial, economic, and social objectives. Most recently, the federal government has developed initiatives such as CEPA that have the potential to place constraints or encroach on a province's water business.[15]

Ontario's environmental laws, primarily the Ontario Water Resources Act (OWR Act) and The Environmental Protection Act (EP Act), prohibit the discharge of contaminants that may impair the quality of water or the environment. The Acts provide for a number of control documents, which set out requirements for dischargers. The Acts make it an offence to impair water quality or to contravene any requirement of the Acts, regulations or control documents. Penalties are outlined for offenses.[16]

In keeping with the Environmental Protection Act, Ontario has begun to develop what is referred to as the Municipal Industrial Strategy for Abatement (MISA). This set of provincial regulations will impose pollution abatement requirements beginning with nine major industrial sectors. The remaining direct dischargers will be subject to the same requirements subsequently in further stages of the program. MISA will impose similar pollution abatement requirements on municipal sewage treatment plants (the tenth sector) in the province. This requirement will include the control of indirect loadings from many thousands of small and medium-sized industries which discharge to some 400 municipal sewer systems in Ontario.

When faced with a pollution problem or a violation of requirements in regulations or control documents, the Ministry of the Environment has a number of potential responses from which it may select one of the following: monitoring regulations, enforcement (prosecution), notification of violation, control orders (legally binding), abatement requests (time limit not to exceed 180 days), and certificates of approval (replaces control orders if terms fulfilled by works specified in certificate).

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[14] Economics of Municipal Water Supply, op cit., pg. 14.

[15] ibid, pg. 15.

[16] Ministry of the Environment of Ontario, Municipal Industrial Strategy for Abatement: A policy and program statement of the Government of Ontario (1986).

4.5 MUNICIPAL JURISDICTION

Although provincial governments have the principal constitutional responsibilities for public water supply, water supply responsibilities are in turn mostly delegated to municipal and regional authorities but the provinces retain the role of regulating local public utilities, preserving the environment and ensuring that the public health of the people is not jeopardized by their supply of water. Municipalities and Regional Districts are in the position of providing municipal services to the general public. In the course of providing these services, they manage, operate and are in charge of storm and sanitary sewerage systems, streets, public lands and landfill disposal sites. The majority of the estimated 60,000 people who provide these sector services are employed by municipal and regional governments. These local authorities spend most of the roughly $2 billion which are invested annually to improve and extend water supply and wastewater systems.[17]

Jurisdictional Issue:

- An obvious consequence from this division of responsibilities for sector services is that there is a certain amount of confusion and inefficiency. Some problems which merit attention are overlooked or are not attacked effectively because of uncertainties about responsibilities and available resources.[18]

4.6 FEDERAL/PROVINCIAL AGREEMENTS

Federal/provincial agreements have been negotiated over the years to deal with a whole range of issues, varying from medicare to regional economic development and water resource management. CEPA gives the Minister of the Environment the authority to conclude, with the approval of the Governor in Council, two types of agreements with provincial and territorial governments. "Administrative agreements" which involve activities such as inspection, enforcement, monitoring and reporting. "Equivalency agreements", as previously referred to are also an available option.[19] Probably the most important federal-provincial agreement in terms of water quality is the Canada-Ontario Agreement Respecting Great Lakes Water Quality. The Department of Fisheries and Oceans, Environment Canada, the Ministry of the Environment in Ontario, and the Ministry of Natural Resources are also signatories to a Memorandum of Intent outlining their responsibilities in terms of habitat management which has implications for water quality. Other federal/provincial agreements pertaining to the Great Lakes Remedial Action Plans are outlined in Chapter 5.0 of this document.

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17 Grover and Zussman, op cit., pg. 17.

18 ibid, pg. 18.

19 Environment Canada. Canadian Environmental Protection Act: Report for the Period Ending March 1990.

4.7 CANADA WATER ACT (1970)

This piece of legislation is designed to provide for the management of the water resources of Canada, including research and planning and implementation of programs relating to the conservation, development and utilization of water resources. The Act provides for unilateral federal action for interjurisdictional basins where all reasonable efforts to reach agreement with provinces have failed and where there is a significant national interest.

Such actions would be designed to:

- inventory, provide data, or otherwise research such waters,
- formulate comprehensive water resource management plans; (pt. 2);
- design projects for the efficient conservation, development, and utilization of those waters (pt. 3); and,
- implement any plans or projects referred to in points 2 and 3.

For interprovincial basins however, the unilateral action provision extends only to planning activities. Only for international basins, where Parliament has firm authority through the Boundary Waters Treaty, does the Act provide for unilateral federal implementation of planned projects.

Part II of the Canada Water Act provides for the establishment of water quality management agencies to plan and implement programs to restore, preserve, and enhance water quality in designated areas.

Such agencies would be designed to:

- maintain continuing consultation on water resource matters;
- advise on the formulation of water policies and programs, and,
- facilitate the coordination and implementation of water policies and programs.

Part II provides for unilateral federal action when federal/provincial agreements cannot be reached but, unlike Part I, the provision extends to the actual implementation of the programs. Part II, however, is only applicable in situations that have become of urgent national concern.

The Minister may also enter into agreements with one or more provincial governments that have an interest in the water quality management of:

- any federal waters;
- any waters, other than federal waters, the water quality management of which has become a matter of national concern.

Such an agreement shall authorize the Minister, in conjunction with the provincial government(s) involved, to procure the incorporation of a corporation without share capital, or to name an existing crown corporation or corporation that performs any function or duty on behalf of the Government of Canada or the government of a province, as a water quality

management agency to plan, initiate, and carry out, in conjunction with the Minister and the provincial government(s), programs described in such an agreement.

Such an agency may then assume the powers to:

- ascertain the nature and quantity of waste present therein and the water quality level, and,
- develop and recommend to the appropriate provincial ministers involved and the Minister of the Environment a water quality management plan.

Approval of such a plan allows the agency, in order to implement the water quality management plan, to;

- construct and operate waste treatment facilities;
- collect any charges for waste treatment at such a waste treatment facility;
- collect effluent discharge fees payable by any person for the deposit of waste in waters specified in the plan.

For water quality management areas, the Governor in Council may make regulations prescribing:

- charges paid by any person to the agency;
- water quality standards, and,
- effluent discharge fees.

No regulation made by the Governor in Council is enforceable unless made on the recommendation of the agency; or on the basis of a joint recommendation by the Minister and ministers of each provincial government party to the agreement where there is disagreement with the recommendations of the agency.

4.8 CANADA - U.S. GREAT LAKES WATER QUALITY AGREEMENT[20]

The purpose of this agreement was to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem. The agreement does not discuss individual funding responsibilities for the RAPs. It was agreed that maximum effort would be made to develop programs, practices, and technology necessary for a better understanding of the Great Lakes Basin Ecosystem and to eliminate or reduce to the maximum extent practicable the discharge of pollutants into the Great Lakes System. Among other things, both governments were made responsible for:

- financial assistance to construct publicly owned waste treatment works will be provided by a combination of local, state, provincial, and federal participation; and,

[20] 1978, Phosphorous Load Supplement 1983, Protocol amendment 1987.

- coordinated planning processes and best management practices will be developed and implemented by the respective jurisdictions to ensure adequate control of all sources of pollutants.

Article VI of the agreement outlines 12 specific elements of programs and other measures required by both Canada and the U.S. in order to implement the GLWQA. These programs and measures cover the following:

- pollution from municipal and industrial sources;
- inventory of pollution abatement requirements;
- eutrophication;
- pollution from agricultural, forestry, and other land use activities,shipping activities, dredging activities, onshore and offshore facilities,
- hazardous polluting substances;
- persistent toxic substances;
- remedial action plans;
- lakewide management plans;
- pollution from contaminated sediments and groundwater.

With respect to pollution from **municipal sources**, both governments were made responsible for:

- provision of required financial resources to ensure prompt facilities construction;
- construction/operation of waste treatment facilities in municipalities to provide levels of treatment consistent with the general objectives;
- development/implementation of practical programs for reducing pollution from storm, sanitary, and combined sewer discharges; and,
- enforcement programs to ensure that the above pollution abatement requirements are fully met.

These programs were to have been completed and in operation no later than December 31, 1982.

With respect to pollution from **industrial sources**, both governments were made responsible for:

- establishment of waste treatment or control requirements expressed as effluent limitations; and,
- establishment of enforcement programs to ensure the above pollution abatement requirements are fully met.

These programs were also to have been completed and in operation no later than December 31, 1983.

Article VII of the agreement reiterates the responsibilities of the International Joint Commission (IJC) as applicable to the GLWQA. The IJC has been given primarily an advisory role, in

addition to its responsibilities for the collection, analysis, and dissemination of data and information. The IJC is obligated to report biennially concerning progress toward the achievement of the General and Specific Objectives of the Agreement.

Annex 2 of the Agreement (as amended by the 1987 protocol) sets out General Principles for Remedial Action Plans (RAPs) and Lakewide Management Plans, procedures for designation of Areas of Concern (AOCs), and detailed elements of both Remedial Action and Lakewide Management Plans for Critical Pollutants. With respect to the RAPs, the Agreement calls for federal responsibility for the following:

- definition of environmental problem, causes and uses of impairment in the AOC;
- evaluation of remedial measures in place, alternative measures to restore use, and selection of additional remedial measures;
- identification of responsibility for implementation of RAPs;
- evaluation of remedial measure implementation and effectiveness; and,
- surveillance and monitoring processes to track the effectiveness of remedial measures and the eventual confirmation of the restoration of uses.

4.9 CANADA ONTARIO AGREEMENT RESPECTING GREAT LAKES WATER QUALITY[21]

The current Canada Ontario agreement replaced an earlier agreement made in 1982, and was designed to reflect obligations assumed under the revised Canada-U.S. Agreement in place at the time. The three basic policy statements of the Canada-U.S. Agreement have been adopted in this agreement, including an agreement to provide financial assistance to construct publicly owned waste treatment works. In addition, the agreement called for equal cost-sharing between the federal and Ontario governments of expenses pursuant to programs and measures, up to a maximum annual combined contribution of approximately $3.75 million. Contributions were to be made in the years 1985/86, through 1990/91. Of these funds, $3.2 million were to be used annually for nearshore surveillance, research and other activities. Additional funds were for the implementation of the Canadian Phosphorous Management Plan.

With respect to the construction of municipal sewerage facilities, Canada assigned all matters of program implementation to the Province subject to the provisions of this agreement, recognizing that Ontario has complete control over supervision of municipal spending. The federal government also agreed to provide an amount not to exceed $9.7 million over two years (no adjustment for inflation) to complete this program. Up to $7.9 million was to be provided in year one (1985/86), and up to $1.8 million in year two (1986/87). The maximum program contribution to municipal sewer projects was not to exceed 66 2/3% of the eligible project cost.

The following is an outline of specifically-stated obligations of both Ontario and Canada in implementing the Canada-Ontario Agreement:

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[21] 1971, Revised 1976, Revised 1982, Revised 1985, expired March 31, 1991, currently under renegotiation.

Ontario agreed to:

- require municipalities meeting specified criteria to construct/operate municipal waste treatment facilities necessary to achieve the objectives of the Agreement. Programs were to have been in place no later than March 31, 1987.

- establish requirements for the control of thermal discharges with respect to industrial sources (in consultation with Canada).

- establish requirements to minimize adverse environmental impacts of water intakes with respect to damage to fish (in consultation with Canada).

- establish pre-treatment requirements for all industrial plants discharging waste into publicly-owned treatment works where such industrial wastes containing hazardous polluting substances are not amenable to adequate treatment or removal using conventional municipal treatment processes.

- develop/implement programs for reducing pollution from storm, sanitary, and combined sewer discharge.

Canada agreed to:

- impose controls on radioactive discharges into the Great Lakes System necessary to meet the objectives of the agreement (in consultation with Ontario).

Canada and Ontario agreed to:

- establish effluent requirements/limitations for the construction and operation of industrial waste treatment facilities;

- establish requirements for substantial elimination of discharges of persistent toxic substances;

- implement the Canadian Phosphorous Management Control Program.

With respect to Areas of Concern (AOC), the Agreement calls for joint development and implementation of RAPs. Both parties are obligated to assess and report AOCs to the International Joint Commission. All efforts were to be coordinated through the Board of Review. This board is comprised of ten members, five appointed from both Ontario and Canada. The agreement stops short of outlining implementation and/or financial responsibilities for the RAPs.

4.10 CANADA-ONTARIO MEMORANDUM OF INTENT ON THE MANAGEMENT OF HABITAT

This agreement was established to implement the Department of Fisheries and Oceans' 1986 policy for the Management of Fish Habitat in Ontario, by enabling Ontario to exercise responsibility for the management of fish habitat and by clarifying the roles of the parties in fish habitat management in Ontario.

Among other provisions in the agreement, both parties agreed to develop for approval by the Canada-Ontario Fisheries Advisory Board (CONFAB), a plan for undertaking cooperative rehabilitation and development work; this plan was to include a list of sites and priorities, cost-sharing and work-sharing arrangements, and guidelines.

Ontario was given the lead role in habitat restoration and development work in Ontario waters, agreeing to provide financial support to outside groups as appropriate, to coordinate co-operative action involving federally sponsored programs with provincial and local organizations, and to develop on a priority basis arrangements its ministries and agencies, in keeping with the purpose of the agreement.

Canada agreed to play what is largely a supportive role, supplying Ontario with information and technology on habitat rehabilitation and development from other areas of Canada, and also to develop on a priority basis arrangements among its departments and agencies to meet the purpose of the agreement.

Canada's Green Plan (1990) announced further commitments to the protection of fish and fish habitat through strengthening of enforcement powers, improvement of legal and administrative steps necessary to promote greater consistency of such enforcement, and increased efforts to expand scientific assessment, monitoring, and research on toxic substances and their effects on fish and fish habitat.

5.0 EXISTING PROGRAMS

The following section provides a summary table (Figure 5-1) of federal and provincial funding programs that have been identified to date and that are relevant to the implementation of RAPs. The information presented in this table is intended to give an overview of the scope and funding levels of existing programs and their ability to support RAP activities as they relate to the following six categories:

- STP Sewage Treatment Plant
- IND PS Industrial Point Source
- URB RO Urban Run-off
- AGC NPS Agricultural Non-point Source
- HAB RES Habitat Restoration
- MIT ACT Mitigative Action

The summary gives an overview of actual program expenditures on an annualized basis. This table also indicates where programs are for a limited term, rather than being ongoing programs funded on an annual basis. This provides an indication of the funding currently committed for the next few years. The summary also classifies the identified programs as being of either primary or secondary use.

Primary use is referred to where a program is believed to have a high degree of potential for direct impact on water quality (i.e. through funding of capital and operational costs), and is indicated by shading in the matrix. Secondary is used to describe programs where an impact on water quality occurs through technical assistance, research or other more indirect methods. Such funding is indicated by a clear box in the table. By classifying programs in this manner, a better understanding of available financial assistance, and the potential for application of these funds to the RAPS will be obtained.

It should be noted that there is a cost associated with tax expenditures such as the federal and provincial capital cost allowances (CCA) available on the purchase of water pollution abatement technology. These costs represent indirect funding for water pollution abatement which has not been included in the summary of federal and provincial funding programs for RAPs. However, with increased pressure to implement abatement measures, the CCA could represent a considerable cost to both governments.

It is important to recognize that there are significant limitations to a review of this type. For example, funding levels identified in Figure 5.1 represent maximum possible funding under each program, and have not been adjusted to reflect their likely availability for the RAP implementation needs identified. In reality, although each of these programs is relevant to specific remedial activities, total potential funding for RAPs from these sources would more than likely be considerably less than the funding levels indicated in this table.

In addition, it is important to note that under existing capital grant programs the province assists in financing approximately 33% of the overall water and sewer infrastructure, leaving municipalities with 67% of costs. On an individual municipal basis, these contributions do vary. Municipalities such as Toronto would be expected to contribute 85% of the costs for growth related components and 67% for environment/health related components. Smaller municipalities may be expected to contribute only 15% of total costs.

A more descriptive overview of each of these programs is provided in Annex B detailing the following information: program name, objectives, timeframe, activities supported, funding method, resources, eligibility criteria, and any general comments.

FIGURE 5.1: FEDERAL AND PROVINCIAL PROGRAM EXPENDITURES SUMMARY

RAP ACTION	PROGRAM NAME	AVG. ANNUAL EXPENDITURES	PROGRAM TERM
STP/WTP	Municipal Infrastructure Grants (P)	$160,000,000	Annual
	PRIDE (P)	18,000,000	Annual
	Subtotal:	$178,000,000	
IND PS	Environmental Technologies (P)	6,000,000	5 Year Term (exp. '95)
	Industrial Waste Diversion (P)	8,200,000	Annual
	Subtotal:	$14,200,000	
URB RO	Lifelines: Infrastructure Rehabilitation (P)	8,500,000	Annual
	Metro Toronto Waterfront Water Quality (P)	2,800,000	Annual
	Household Special Waste Collection Grants (P)	$250,000	Annual
	Subtotal:	$11,550,000	
AGC NPS	Food Systems 2002 (P)	$2,000,000	1st 5 Year Term expires
	Integrated Pest Management (P)	540,000	Annual
	Land Stewardship II (P)	12,666,667	3 Year Term (exp. '94)
	Rural Beaches (P)	500,000	Annual
	Ontario Pesticide (P)	400,000	Annual
	Pesticides Research (P)	400,000	Annual
	Subtotal:	$16,506,667	
HAB RES	Wetlands Management (P)	250,000	Annual
	Community Fisheries Involvement (P)	450,000	Annual
	Subtotal:	$700,000	
MIT ACT	Municipal Recycling Support (P)	7,700,000	Annual
	Municipal Reduction/Reuse (P)	330,000	Annual
	Environmental Security Account (P)	17,400,000	Annual
	Environmental and Health Protection Grants (P)	5,000,000	Annual
	Urban Beaches (P)	500,000	Annual
	Great Lakes Cleanup Fund (F)	11,000,000	5 Year Term (exp. '95)
	Environmental Partners Fund (F)	10,000,000	5 Year Term (exp. '95)
	Subtotal:	$51,930,000	
	Total Average Annual Expenditures:	**$272,886,667**	
	Average Annual Primary Expenditures:	$278,816,667	
	Average Annual Secondary Expenditures:	$30,570,000	

Legend:
(F) = Federal Program
(P) = Provincial Program
Shaded Areas = Primary Expenditures

Note: Municipal funding infrastructure costs (normally 66% of costs) are not included in this table.

6.0 ASSESSMENT OF PROGRAM AND FUNDING ADEQUACY

6.1 INTRODUCTION

The adequacy of existing programs/funding mechanisms for the identified RAP activities is assessed in terms of availability of funding for each identified activity, amount of funding and timing of funding. In addition to these considerations, the assessment of program and funding adequacy can also consider factors such as economic efficiency and economic equity. This assessment is limited by the fact that figures in several cost categories are either known to be incomplete, or difficult to obtain clear estimates for. In addition, not all sources of funding summarized here are targeted directly to RAPS. Therefore, this funding assessment presents the maximum possible extent of currently available funding sources.

6.2 ADEQUACY OF EXISTING FUNDING

Figure 5-1 from Chapter 5 shows the annual amount of available funding for each RAP action; this amount corresponds to the "Average Annual Expenditures" column in the figure and is the most important variable in the assessment of funding adequacy. Average annual funding expenditures range from $178 million for Sewage Treatment Plant upgrading to $700,000 for Habitat Restoration. Total average annual funding expenditures amount to just over $272 million. Figure 5-1 also shows that most programs are operated on an annual basis, although several of them are operated on a 3 or 5-year period; this is especially true for Other Remedial Actions.

To compare program funding amounts from Figure 5-1 to RAP costs for the 17 sites (as shown in on Figure 2 - 3 from Chapter 2), the latter costs have to be converted into annual[1] values so that only annual numbers are compared. Figure 6-1 shows the annual funding available for the type of remedial activities proposed in each RAP along with current estimates of annualized costs for each action. All figures are expressed in 1990 dollars. It must be emphasized that identified funding sources are not targeted at RAPs. Therefore, the actual funding available to RAPs will be lower.

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[1] Since the costs appearing in Figure 2-3 are capital costs expressed in present value terms, the annual equivalent is obtained by dividing each figure by a factor for the present value of an annuity of $1 per period for n periods. In the current case, the real discount rate is 10% and the number of periods (n) is assumed to be 20; the corresponding factor is 8.5136. Using a 20-year annuity factor to annualize costs is not inconsistent with costs initially discounted as an infinite stream (i.e. by dividing total costs today by the discount rate) since costs beyond 20 years have a negligible impact on present values.

Figure 6-1 indicates that existing program funding is inadequate to cover RAP costs as they are currently estimated. However, the annual funding identified does not include the municipal portion of funding for STP upgrades. Funding for the two most important RAP actions--Sewage Treatment Plant and Urban Runoff--appears to be insufficient without municipal support. With municipal funding, current programs may be sufficient if they are focused on RAP activities. However, RAP activities will face competing priorities with other sites.

If funding is limited to federal/provincial sources the following observations can be made. In the case of Urban Runoff, the gap between current available funding and cost is very large; available funding constitutes approximately 4 percent of costs. For Sewage Treatment Plants, available federal/provincial funding constitutes approximately 58 percent of costs. While annual available funding for several individual RAP actions exceeds their annualized costs, total annual available funding still only constitutes 41.9 percent of total annualized costs. In other words, reallocating funding from those activities whose funding exceeds costs will not close the overall gap in funding. It should be recognized that the same limitations on estimates of program funding discussed in chapter 5.0 carry over to this comparison of existing funding vs. cost requirements.

It is important to note that the Ministry of the Environment, in keeping with its adoption of the polluter-pay-principle (PPP), expects that the industry would bear the costs of abatement for industrial point source degradation. In addition, as stated earlier, both federal and Ontario governments provide indirect funding for these expenditures through their capital cost allowance provisions. In light of this position, funding levels for this category of remediation (which are currently at approximately 26% of annualized costs) could be considered to be sufficient. However, these costs are recognized as being underestimated.

The inadequacy of funding provided through existing (subsidy) programs necessitates an examination of alternative funding mechanisms that would allow the gap between available funding and actual RAP action costs to be closed. Chapter 7 will provide a thorough discussion and analysis of alternative funding mechanisms with respect to criteria of economic efficiency, economic equity, administrative and institutional simplicity, etc. In addition, Chapter 7 will discuss the adequacy of existing programs against these criteria.

FIGURE 6.1: ASSESSMENT OF PROGRAM AND FUNDING ADEQUACY

RAP ACTION	Annual Funding ($)	Annualized Cost ($)
Sewage Treatment Plants	178,000,000	307,610,313
Industrial Point Source	14,200,000	53,399,495
Urban Runoff	11,550,000	251,680,738
Agricultural Non-Point Source	16,506,667	7,987,254
Sediments	N/A	23,163,038
Habitat Restoration	700,000	2,898,904
Other Remedial Actions	51,930,000	3,876,168
TOTAL	$272,886,667	$650,561,878

Note: Cost figures include only capital costs. In addition, these costs do not incorporate the municipal portion of water and sewage financing. Generally, this represents 66% of total costs.

7.0 ALTERNATIVE FUNDING MECHANISMS

7.1 INTRODUCTION

Assessing the potential contribution of funding mechanisms to the success of RAPs requires the identification and documentation of alternative and innovative programs and funding mechanisms which could be used to finance RAP implementation activities. This task also requires a ranking of these mechanisms according to criteria such as "traditional" versus "innovative", and an assessment of advantages and disadvantages related to each. In addition, alternative and innovative programs and funding mechanisms need to be evaluated in relation to cost allocation principles such as the Polluter-Pay, User-Pay and Beneficiary-Pay principles.

7.2 COST ALLOCATION PRINCIPLES

The use of funding mechanisms for RAPs requires principles in order to allocate the costs of remedial actions to be undertaken. Three generic cost allocation principles are identified and discussed below: the Polluter-Pay Principle (PPP), the User-Pay Principle (UPP), and the Beneficiary-Pay Principle (BPP). These principles are generic in the sense that each of them can accommodate a large number of cases in practice. However, this does not mean that the three principles are mutually exclusive in their application. While some simple cases will dictate the choice of a given cost allocation principle by eliminating alternatives, more complex cases will require a combination of more than one principle in practice. In the simple case, for instance, the absence of (or impossibility to identify) a polluter will eliminate the Polluter-Pay Principle and restrict the choice to the two remaining principles. In a complex case (a large city, for instance), the presence of industries, large infrastructure and recreational activities linked to a resource, one principle will not be sufficient to allocate all the relevant costs.

The application of funding mechanisms and cost allocation principles will have implications with respect to efficiency, equity and income distribution. These implications are important issues that have to be considered in the current context. The evaluation of funding mechanisms will be made according to the following criteria:

- Economic efficiency: net benefits to the community should be maximized;
- Economic equity: amounts paid should be related to the economic costs that are imposed on the community; and
- Income distribution: changes in economic welfare of each party resulting from the funding mechanism(s) and cost allocation principle(s) selected should be assessed.

The efficiency and equity criteria are based on economics; therefore, results can be ranked on the basis of their economic desirability. On the other hand, the income distribution criterion cannot be based on economics alone because it involves a value judgement as to which income distribution outcome is preferred. This is a matter for public policy.

7.2.1 Polluter-Pay Principle (PPP)

The PPP is a cost allocation principle for the deterioration of environmental resources. The principle, as defined by OECD, means that,

> "The polluter should bear the cost of measures to reduce pollution decided upon by public authorities to ensure that the environment is in an 'acceptable state'."[1]

The mechanisms for implementing the PPP that are relevant to RAPs are the following: first, setting standards and letting the polluter support the costs of achieving them; and second, setting charges or taxes on polluting products (outputs) or inputs. Although the PPP refers to making the polluter pay, it does not restrict the polluter-producer, for instance, from passing on the resulting increases in his production costs to consumers if he can do so. This situation is not inconsistent with the PPP since the price mechanism will simply signal the "true" costs of production to the consumer, including all costs of preventing adverse environmental impacts or maintaining environmental resources in an acceptable state.

Then, the full application[2] of the PPP is economically efficient because:

- it is based on the assumption that society aims to achieve the optimal level of pollution (or, in practice, an acceptable level of pollution);
- it provides a clear market signal to polluters and consumers alike; and
- it does not matter how much of the costs the polluter shifts forward to consumers as long as the full control costs are paid (i.e. as long as externalities are internalized).

The full application of the PPP is economically equitable as well because:

- the polluter pays according to the costs he imposes on the environment, as established using appropriate standards;

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1 J.B. Opschoor and H.B. Vos, *Economic Instruments for Environmental Protection*, Paris: OECD, 1989, p. 27.

2 "Full application" refers to the case in which costs are fully recovered from responsible or related parties. This concept extends to the User-Pays and Beneficiary-Pays Principles as well.

- the consumers of the polluter's output may contribute to the costs since they contribute to the problem as well;[3] and

- there is no cross-subsidisation of polluters by parties that are unrelated to the problem.

While the PPP appears to be the international standard cost allocation principle, this does not suggest that Canada should be constrained to choose this route. Alternative principles can be satisfactory depending on the Canadian circumstances.

7.2.2 User-Pay Principle

The User-Pay Principle is a cost allocation principle for the consumption of environmental resources. The principle means that the user of the environmental resource should bear the cost of satisfying his demand for the resource. Unlike the PPP, the User-Pay Principle allocates costs on the basis of current and future resource use rather that on the basis of past and current resource damage.

Since the UPP requires that users pay for services rendered according to the costs they impose on the system, its application is only feasible when consumption of the resource or environmental good can be measured. Consequently, the UPP is often used in the case of domestic water services. In addition, the principle is also suitable for the use of recreational facilities by individuals, i.e. to support user fees for a park, for example. The application of the User-Pay Principle is equivalent to that of the PPP when the polluter of the resource is also its user. This can be observed, for instance, in the case of a plant that uses water for cooling purposes and dumps the effluent in a lake.

Adherence to the UPP simply increases as the share of the costs borne by the user increases. The full application of the User-Pay Principle is economically efficient because:

- the resource is allocated to users on the basis of their willingness to pay; and,

- it provides a clear market signal to users regarding the cost of using the resource.

In addition, the full application of the User-Pay Principle is economically equitable because:

- the user pays according to the costs he imposes on the environment, as established using appropriate standards; and

- there is no cross-subsidisation of users by parties that are unrelated to the use of the resource.

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[3] The extent of the consumers' contribution will depend on the slopes of market supply and demand curves.

7.2.3 Beneficiary-Pay Principle

The Beneficiary-Pay Principle is a cost allocation principle for the consumption of environmental resources. The principle means that the beneficiary of the environmental resource should bear the cost of making the resource available for his use and enjoyment. In other words, according to this principle, the beneficiary should pay for the benefit he derives from the resource. Unlike the PPP or the User-Pay Principle, the Beneficiary-Pay Principle allocates costs on the basis of the beneficiary's theoretical willingness to pay for the resource. The word "theoretical" is used for two reasons: first, to distinguish between willingness to pay, which is the principle underlying the User-Pay Principle, and second, to make clear that the beneficiary who accepts to bear the cost of making a resource available to him is, by definition, willing to pay at least this amount to use the resource.

The Beneficiary-Pay Principle can be used, for instance, in the case in which remedial action in a river (upstream) results in aesthetic improvements, restoration of fish habitat, swimmable water, etc. in a lake (downstream). In this case, people who live downstream are beneficiaries in the sense that they derive a benefit from the remediation.

Adherence to the Beneficiary-Pay Principle simply increases as the share of the costs borne by the beneficiary increases. The full application of the Beneficiary-Pay Principle is economically efficient because:

- the resource is allocated to users on the basis of the benefit they derive from its use and enjoyment; and
- it provides a clear market signal to beneficiaries regarding the value of the resource.

In addition, the full application of the Beneficiary-Pay Principle is economically equitable because:

- the beneficiary pays according to the benefits he derives from the use and enjoyment of the resource; and
- there is no cross-subsidisation of beneficiaries by parties that are unrelated to the use and enjoyment of the resource.

In practice, the Beneficiary-Pay Principle may be fairer than the User-Pay Principle in the case of public environmental goods or services whose benefits extend beyond the specific users of these goods or services. However, the application of the Beneficiary-Pay Principle may be problematic since it is generally difficult to identify beneficiaries and the extent of the benefits they receive.

7.3 FUNDING MECHANISMS

There are five generic categories of financing mechanisms considered relevant for the purposes of RAP funding and/or financing:

- debt;
- taxes;
- subsidies;
- charges; and
- other instruments.

Debt is a purely financial instrument, while taxes, subsidies and charges can all be defined as economic instruments since they are meant to alter market functioning. Debt includes stock and bonds; taxes include levies on income, property or specific commodity sales or transactions; subsidies includes grants, soft loans and tax allowances; and charges include user fees and other fees paid for service. Instruments not part of the four previous generic categories are included in a group called "other instruments".

The discussion that follows is organized according to a spectrum of financing mechanisms, ranging from traditional ones to innovative ones. The first four categories listed above appear in that order in the discussion, debt being the most "traditional" mechanism and charges being the most "innovative" one. Other instruments are discussed at the end but outside the spectrum nonetheless since they include a number of heterogeneous funding mechanisms that cannot be labelled as "traditional" or "innovative" as a group.

More traditional mechanisms can generally be thought of as financing tools that:

- have been available and in use for a long time;
- require financial contributions from parties that are unrelated to the consumption of the resource and/or the resulting problem; and
- are funded by the general budget.

On the other hand, innovative mechanisms can be thought of as financing tools that:

- require financial contribution from parties that are related to the consumption of the resource and/or the resulting problem; and
- are funded by parties that are related to the consumption of the resource and/or the resulting problem (e.g. through charges).

It is worth noting that no financing mechanism is truly innovative in itself since international experience covers the whole spectrum of financing mechanisms, from the most traditional ones to the most innovative ones.

7.3.1 Traditional and Innovative Funding Mechanisms

7.3.1.1 Debt

Financing through loans secured outside the context of subsidies can be classified as pure debt financing. There is a variety of financial instruments that are available to finance local remedial action and/or infrastructure projects, such as taxable municipal bonds and tax-exempt bonds. Short-term debt, such as fixed rate notes and tax-exempt commercial paper, is generally used for interim financing while awaiting issuance of long-term debt or government aid. Short-term debt is also used during periods of high interest rates; it is then converted to long-term debt once interest rates go down.

Innovative arrangements to use the debt instrument include industrial development bonds, and zero coupon bonds and variable rate demand notes (VRDN). Industrial development bonds are limited-liability instruments which are issued to encourage industrial development and/or employment by financing private firms. The debt service on such bonds is simply paid by rental payments from firms, as specified in long-term contracts. This arrangement is representative of public-private partnerships or schemes for corporate participation in project funding.

Zero coupon bonds and VRDNs are arrangements designed to make debt attractive to lenders. Zero coupon bonds are sold at a discount of their value at maturity and pay no interest until then; in addition, their value (price) fluctuates as interest rates vary. VRDNs usually mature in two to three years and their interest is adjusted on several occasions to reflect changes in the market. Moreover, VRDNs feature a minimum interest rate to protect the investor and a maximum rate to protect the issuer, and can be cashed prior to maturity without penalty. Again, these arrangements improve the ability to secure financing for projects by using the market.

The only available evidence on the use of debt as a funding and financing instrument explicitly for environment projects can be found in the United States. In 1989, 12 states authorized more than $1.2 billion in general obligation and revenue bonds to fund environmental projects. The proceeds range from $20,000 for the Virginia Reclamation/Gas and Oil Bonds to $150 million for the New Jersey general obligation bonds for its Wastewater Treatment Trust Fund. Approximately $700 million came from New Jersey's eleven bond programs. Almost 70 percent of the bond proceeds are used to finance capital projects for water and wastewater treatment. The remainder is used for clean-up activities, pollution control and waste collection and treatment. While the majority of the bonds issued are of the general obligation type, there is an increasing trend in using revenue bonds instead of general obligation bonds.

In Canada, the Province of Ontario plans to establish the Ontario Capital Fund beginning in the 1991-1992 fiscal year, as per the 1991 Ontario Budget.[4] The intent of this fund is to improve public infrastructure capital investment planning by providing a clear distinction between operating and capital expenditures and, more importantly, by considering financing of capital spending from a borrowing perspective, rather than a current-year tax revenue perspective.

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[4] Ministry of Treasury and Economics, *1991 Ontario Budget*, Toronto: Queen's Printer for Ontario, 1991.

Activities such as RAPs will be affected directly by this new capital fund, as:

> Concern about the natural environment also demands that we take a fresh look at how to use infrastructure support to encourage certain activities, such as conserving energy and reducing pollution.[5]

The implications of these new provisions for funding are: first, in times of revenue pressures, the incentive to defer capital spending will be minimized since these expenditures will depend less on current-year tax revenues and its impact on the Provincial deficit, and second, total provincial borrowing may increase. While the breakdown of planned capital expenditures for the 1991-1992 fiscal year is not provided in the 1991 Ontario Budget, capital spending will nonetheless total approximately $4.3 billion for that year.

7.3.1.2 Taxes

Taxes levied upon income, property or specific commodity sales or transactions are generally used to raise revenue in order to allow the general budget (or a part of the general budget) to finance various expenditures. A portion of these revenues can also be put into "earmarked" funds to be used for funding or financing specific environment-related projects.

Innovative arrangements to use the tax instrument include Tax-Increment Financing (TIF) and exactions. The TIF is usually tied to property taxes and generates revenue by using dollar increments in tax collections resulting from increases in property values or expansion of the property tax base through new development. These revenues are then dedicated to water and wastewater (or other) projects.

Exactions constitute tax increases that are levied on certain groups such as new users of water or wastewater services. They can take various forms and their incidence can be quite diverse: connection fees; impact fees; benefit district tax; and access fees. Connection fees are generally collected from home owners in new subdivisions. Impact fees are collected from developers to obtain approval for packages including a number of utilities such as water and wastewater, transportation and other services. Benefit district (or special assessment) tax is like a surtax collected from owners whose property values increase as a result of infrastructure improvements on adjacent houses or neighbourhoods. Finally, access fees are up-front payments collected from firms and others to ensure that payers will receive the services from facilities to be constructed using access fees revenues.

The only available evidence on the use of taxes as an economic instrument[6] can be found in the United States. Recent survey evidence suggests that there were thirty-seven tax programs in use in sixteen states in 1988, with total revenues of more than $491 million. Tax program

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5 *ibid.*, p. 78.

6 This excludes tax differentiation schemes (which increase existing taxes on products harmful to the environment and decrease existing taxes for clean alternatives) since they are revenue neutral.

information is available for the following states: California, Florida, Iowa, Kentucky, Maryland, New Jersey and Washington. California imposes both an Air Program Tax and a surcharge per kilowatt to utilities. The revenues from the Air Program tax are used to finance program activities; no details on the use of the electricity surcharge revenues are available. Florida imposes a "documentary" tax on all real estate transactions whose revenues are used for the acquisition and management of floodplains and wetlands. Florida also uses TIF to secure funds for development projects. In Iowa, TIF is used to fund supporting economic development and infrastructure projects in zones targeted for development, while they are used in Maryland to overcome limits on property tax collections. In Kentucky, a tax on the quantity of hazardous waste generated is assessed on the owners of waste-generating facilities and its revenues are used to cover administrative and operating costs and to support state-establish trust funds. The State of New Jersey imposes a water tax on water delivered to consumers. The revenues collected are used for the administration of Safe Drinking Water programs, delivery of water to consumers, research and enforcement. The State of Washington imposes both a Litter Control Tax and a Tobacco Tax. The Litter Control Tax is an ad valorem [sales] tax levied upon all businesses engaged in manufacturing [wholesaling and retailing] of products that generate litter. From 70 to 80 percent of the revenues generated by this tax are dedicated to litter control along state roads and highways; the remainder is dedicated to state recycling programs. The Tobacco Tax is levied on sales of tobacco products, alcohol and water pollution control equipment. Its proceeds are used to finance ground-water protection projects and water pollution control activities.

7.3.1.3 Subsidies

Subsidy programs such as grants, soft loans and tax allowances seek to achieve a variety of objectives through financial incentives. These objectives can include (but are not limited to) the following: providing basic water supply to low-income families or communities; helping firms and farmers in sudden cash shortage in the face of additional investment needs; stimulating the development of new "clean" technologies; and encouraging regional economic development. In addition, subsidies can be awarded to local governments to improve their wastewater treatment and clean-up in order to reduce spill overs on other jurisdictions (whenever they constitute a problem).

Innovative arrangements to use subsidies include non-market loans, and subsidized market loans and credit enhancements. Non-market loans can be offered through schemes such as revolving funds. Such funds were once created for environmental purposes and are maintained by paybacks from expired soft loans instalments and incidental donations. Revolving funds were capitalized as government grants declined in importance, thereby allowing local self-financing of projects. In practice, loans from a revolving fund carry interest rates that are lower than those for either commercial or tax-exempt loans. In general, the subsidy implicit to a revolving fund is higher than that of other subsidized loans since the capitalization received by federal and state governments is considered free.

Subsidized market loans and credit enhancements are designed to reduce the cost of borrowing and attract lenders. The funds to offer subsidized market loans are generally borrowed by a government agency which can command an interest rate lower than that for corporations because of the implied guarantee. Credit enhancements are done through government-sponsored

enterprises that engage in secondary debt trading. For infrastructure, these enterprises can be bond banks, debt pooling agencies or enterprises reselling debt instruments. Credit enhancements are attractive to lenders since they diversify their risk (through pooling) and allows them to convert long-term income streams into immediate cash (although probably at a discount). The advantage of subsidized market loans and credit enhancements is that they can reduce borrowing costs by improving market efficiency. They can achieve this result by reducing transaction costs and improving the quality of information to lenders; this information can indeed be very important in the case of small local authorities whose risk is unknown to lenders and that cannot borrow at reasonable rates through normal channels.

International experience with subsidies for funding and financing of water and wastewater infrastructure projects is abundant. All OECD member countries, except Australia, Belgium, Japan, Switzerland and the United Kingdom, have subsidy programs of some sort. Figure 7-1 provides an overview of subsidy systems in use in OECD member countries. Examples of applications on a country basis are discussed below, along with a brief evaluation of the measures (whenever information is available). Details on applications in Finland and Norway are not available.

Canada. The only evidence available for Canada concerns the Province of Ontario. Many environment-related projects in Ontario are financed by grants. For instance, grants are provided for construction of water and wastewater facilities, energy recovery programs, conservation, education and training, and research.

Denmark. The country provides subsidies to farmers in abating nutrient discharges and to industry for promoting the development of clean technologies. The subsidy to farmers is temporary and designed to help farmers avoid severe financial problems, while the subsidy to industry is to support adoption of new technologies.

France. The subsidy system in France is closely linked to the charge system, in the sense that revenue from charges are generally used to finance subsidies. However, contributions from the budget are observed for household and industrial waste collection and treatment, and the development of low-noise equipment and means of transportation. In this country, however,

> A slight transition is noticeable from aid in the form of grants to aid in the form of soft loans. Industry sometimes prefers soft loans because the interest is tax deductible, whereas grants are part of the firm's taxable income.[7]

Germany. There exist a variety of different subsidy schemes in Germany, along with relatively strict environmental standards. Authorities consider aid beneficial as long as polluters are held liable for the environmental costs they impose. While application for subsidies is voluntary, certain schemes appear to have produced considerable incentive impacts and eased the adoption of standards. Nonetheless, environmental effectiveness of subsidies in Germany is limited by the lack of information about their availability, excessive administrative burden necessary to apply and the lack of actual results. Similarly, economic effectiveness of the system--in the

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[7] Opschoor and Vos, *op. cit.*, p. 77.

sense of the reduction of environmental pollution with a given subsidy budget--is rated low. In practice, subsidies in Germany generally help firms to deal with the ex post financial costs of regulation, rather than helping to ease the introduction of new regulations.

Italy. The subsidy system in Italy is fairly small and generally aimed at balancing the budgets of lower level authorities. The incentive effects of the system are reported to be minor.

The Netherlands. Financial assistance schemes utilised in the Netherlands consist of compensation payments to industry to promote compliance with regulations, and aid to industry to encourage research on, and the introduction of, clean technologies and pollution control equipment. Laws in the Netherlands include provisions for assistance to firms that face financial difficulties in complying with direct regulations. Details on performance are not available.

Sweden. The only financial assistance scheme in use in Sweden is the "Fuel Environment Fund"; this fund is made of revenues from charges on oil. Assistance is provided for gas cleaning and emissions control measures. A number of financial aid schemes have been ended during the 1980s. The trend in subsidising the replacement of oil by substitutes has been one of replacement of a general subsidy by an incentive to develop and introduce new environmental techniques.

United States. Subsidy schemes are used in the fields of wastewater treatment and noise abatement. These schemes appear to play a minor part in environmental policy in the United States, except for the federal and state construction grant program for wastewater treatment. Environmental effectiveness of the above program is probably low since no evidence exists that,

> Subsidies were a necessary component in carrying out wastewater treatment programs, except for a few communities with serious fiscal problems. The high subsidy in investment costs has promoted the application of capital-intensive solutions, which might have decreased the economic efficiency. A positive correlation has been found between the subsidy share in investment costs and the initially designed reserve capacity of treatment plants.[8]

Recent revisions of the regulations on grant applications in the United States have increased the administrative efficiency of the above program. Financial assistance of up to 80 percent of the planning and implementation costs is provided to airports for noise abatement. As of 1986, approximately 20 airports had completed their noise compatibility plans, with 80 airports currently working on theirs.

Several conclusions on the use of subsidies emerge: (i) there is a downward trend in applications for assistance in the Netherlands, Sweden and the United States. The trend is even more obvious in the United States, where the Federal government intends to reduce its role in most programs, or eliminate programs such as the FMHA rural loan and grant program.

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[8] *ibid.*, p. 81.

FIGURE 7.1: NUMBER OF EXISTING SUBSIDY SYSTEMS IN OECD MEMBER COUNTRIES, BY TYPE

COUNTRY	SUBSIDIES CUM CHARGES	OTHER SUBSIDIES			
		GRANT	GRANT/SOFT LOAN	SOFT LOANS	TAX ALLOWANCE
Canada					1: Air/ Water
Ontario (1)		2: Water/ Waste			1: General
Denmark		2: Waste			
Finland	1: Water 1: Waste	1: Water 2: Waste		1: Air 1: Water 1: Waste	1: General
France	1: Air 1: Water 1: Waste	1: Waste	1: Water/ Waste		
Germany	1: Water 1: Waste	1: General		2: Air 2: Water 2: Waste 2: Noise	1: General
Italy		2: Waste			
Netherlands	1: Water 3: General				
Norway			1: General		
Sweden	1: Air				
United States	1: Waste	1: Waste 1: Air			

Source: OECD (1989)
(1) Ministry of the Environment
Note: Numbers in each cell correspond to the number of programs in use.

Government budget cuts certainly constitute one of the reasons for this trend and the accompanying shift towards subsidies funded through charges; (ii) subsidies appear to be more acceptable whenever the related environmental problems are felt to be more severe.[9] While this may indicate that subsidies are a significant instrument in establishing environmental programs, it is not clear whether the availability of financial support plays a positive role in negotiating on, and imposing, direct regulations; (iii) a shift from assistance supporting end-of-pipe technologies to assistance encouraging development and implementation of clean technologies has been observed in France and Germany. This change may reflect a change from curative to preventive environmental policy; and (iv) there are indications that financial assistance for industry in complying will be substantially reduced in the medium term. On the other hand, support for the development and implementation of clean technologies is likely to be continued and expanded.

7.3.1.4 Charges

Charges constitute a price assigned to a good or service being used and include user fees and other fees paid for service. Innovative arrangements relevant to RAPs for the use of charges as an economic instrument include the following:[10]

- effluent charges;
- user charges;
- product charges; and
- administrative charges.

Effluent charges are payments on direct releases into the environment. Effluent charges are also applied in solid waste management and in the abatement of noise from aircraft. Implementation for these activities is eased by fixed and easily identifiable points of discharge and by applying the charges more often only to large sources of wastes. Effluent charges are chiefly used for financing individual or collective systems of pollution control.

User charges are payments for the cost of treatment of effluent discharge. These are commonly used by local authorities for the collection and treatment of solid waste and sewage water. Where such charges are flat-rate, they may not relate to the amount of use. Indeed, flat rate charges fail to act as an economic incentive to reduce the quantity of effluent discharge.

Product charges are applied to the prices of products which create pollution either as they are manufactured, consumed or disposed of. Lubricants, sulphur in fuels, fertilisers, mercury and

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9 Such as the cases of water pollution treatment and hazardous waste site restoration.

10 J. Nicolaisen and P. Hoeller, *Economics and the Environment: A Survey of Issues and Policy Options*, Working Paper No. 82, General Economics Division, Department of Economics and Statistics, OECD, July 1990.

cadmium batteries, non-returnable containers and pesticides are examples of such goods. Product charges are intended to modify the relative prices of the products and/or to finance collection and treatment systems, such as deposit-refund systems.

Administrative charges are chiefly aimed at funding systems of licensing and licence monitoring. They are applied in many countries.

As shown in Figure 7-2, there is a good body of international experience with charges in general. Examples of applications for each type of charges are discussed below, along with a brief evaluation of the measures.

Effluent Charges. Because of their nature and the way they operate, they are particularly relevant to the RAPs. A large portion of OECD member countries use these charges, except for Canada, Denmark, Finland, Norway and Sweden. Effluent charges are used in some municipalities.

In the field of air pollution, the only "pure" effluent charge is applied in France. It is levied upon firms that have a large power generation potential or discharge more than a given quantity of emissions. The revenues are used to finance air pollution control equipment and research on air quality. Effluent charges do not play an important role in air pollution control, direct regulation being the main instrument. Difficulties in collective treatment and monitoring, and opposition from industrial lobbies hinder the use of air effluent charges.

In the field of water pollution, Australia, France, Germany, Italy and the Netherlands impose effluent charges. The charge in France is levied upon households, firms and municipalities and is aimed at raising revenue to finance water agency expenditures. The charge in the Netherlands has the same objective except that municipalities do not pay it. Germany imposes a charge on households and firms with a clearly stated incentive purpose; revenues can be allocated to administrative costs and assistance to public and private abatement activities. Italy imposes an incentive-based charge on firms only. No details on the charge in Australia are available. On the whole, water effluent charges have been reasonably successful from the point of view of effectiveness, incentive effect and acceptability.

Waste effluent charges are used in Australia, Belgium, Denmark, the Netherlands and the United States. In Belgium, the charge is levied upon firms treating and/or dumping waste, while the charge in Denmark is levied upon firms and households;[11] charges in both Belgium and Denmark have an incentive purpose.

The Netherlands impose a charge to firms treating and/or dumping chemical waste; its objective is to generate revenues for disposal and prevention. In the United States, the charge is imposed on waste site operators and its revenue is used to finance chemical waste site restoration after closure. The objectives of the charge are both of revenue generation and incentive nature. The role of waste effluent charges as a tool for waste management and control is rather small. Their role is hampered by difficulties in establishing the charge base and monitoring, duplication in

[11] The charge for households is collected for domestic solid waste.

the use of effluent and user charges, and the opposition from the agricultural and industrial sectors.

Noise charges are utilized in France, Germany, Japan, the Netherlands, Switzerland, the United Kingdom and the United States. In all countries, the charge is levied upon airline companies. In addition, the Netherlands levy the charge upon large industrial firms. In all countries--the United Kingdom and the United States excepted--the charge is aimed at raising revenue. In the other cases, the charge is primarily an incentive mechanism. However, the charge in Switzerland is imposed with both objectives in mind. The revenues from this charge are used to finance insulation programs in France, Germany, the Netherlands and Switzerland. The effectiveness and acceptability of noise charges are judged to be low. They are indeed strongly opposed by airline companies.

User Charges. Water user charges (rates) are utilized in Australia, Belgium, Canada, Denmark, Italy, Japan, the Netherlands, New Zealand, Norway, Switzerland, the United Kingdom and the United States. In all these countries, water user charges apply to residential and industrial users. Practices regarding water pricing in the commercial sector vary a great deal. Water pollution user charges apply to all countries listed in Figure 7-2 except Japan. These charges are levied upon households and firms and the resulting revenues are used for collection and treatment of wastewater. In the United States there are also hundreds of stormwater utilities that collect stormwater charges based on the amount of runoff; these charges are paid by property owners and the proceeds are used only for the purposes for which the utilities were established (i.e. stormwater conveyance and management). The water pollution charge in Sweden is effective and provides some incentive effect. However, in some municipalities, firms paying large charges actually subsidize households. In the United States, the incentive impact of charges is small because water and wastewater are not separated on bills and polluters can decrease their water use while the level of pollutants remains the same. By the same token, strength charges are generally ineffective as charges are based on classes of firms and monitoring costs are high.

FIGURE 7.2: APPLICATION OF TYPES OF CHARGES

COUNTRY	EFFLUENT						
	Air	Water	Waste	Noise	User	Product	Admin.
Australia		●	●		●		●
Belgium			●		●		●
Canada					●		
Denmark			●		●		●
Finland					●	●	●
France	●	●		●	●	●	
Germany		●		●	●	●	●
Italy		●			●	●	
Japan				●			
Netherlands		●	●	●	●	●	●
Norway					●	●	●
Sweden					●	●	●
Switzerland				●	●		
United Kingdom				●	●		●
United States			●	●	●	●	

Source: OECD (1989)

User charges on the collection of solid waste are in use in all countries in Figure 7-2 except Japan. These charges apply to households and firms in all countries except Belgium where they only apply to households. Target groups for Germany and the United States are not available. In Finland, user charges are used to operate waste treatment plants, while the French user charge system is set to recover costs of household waste collection. The efficiency and acceptability of the charge are thought to be low.

User charges are generally considered as normal payments with respect to services received and thus rarely act as incentives; in most cases, they are set to recover costs. There appears to be a tendency to separate monitoring for large sources or replace separate charge systems by already existing taxes systems, which are easier to implement and enforce. Equity and incentive effects could be improved by relating charges more closely to quantity and quality of discharges. Acceptability and effectiveness of user charges are judged to be high. However, their incentive effects are small or nil, and they do not encourage prevention and recycling.

Product Charges. These charges are in use in the following countries: Finland, France, Germany, Italy, the Netherlands, Norway, Sweden and the United States. Finland imposes such charges on non-returnable containers, lubricant and crude oil and products. Their objective is to raise revenue, except for containers (incentive). The revenues are used to support the deposit-refund system for bottles. France and Germany impose a charge on lubricant oils only, which is aimed at raising revenue to finance collection, treatment and disposal of these products (at least in France). In Italy, a charge is imposed on lubricant oils and plastic bags. The revenues from the charge on oils are used to finance their collection, recycling and disposal, while the charge on bags is strictly incentive-based. In the Netherlands, charges apply on lubricant oils, fossil and car fuels. The objective of these charges is to collect revenue to finance Ministry of the Environment's policy programs. Norway's product charges aim at non-returnable containers, fertilisers, pesticides and mineral oil. Container charges on containers and oil are incentive-based, while those on fertilisers and pesticides are designed to raise revenue to finance environmental programs in the agricultural sector. Product charges are a popular instrument in Sweden: they are levied from transactions involving oil products, fertilisers, pesticides, batteries and beverage containers. All charges (except those on oil products) seek to both provide incentives and raise revenue. Revenues from the oil charge are used to finance both environmental and non-environmental programs, while revenues from fertiliser and pesticide charges are used to finance research on agriculture and forestry. Finally, the product ("Feedstock") charge in the United States is imposed on petroleum, base chemicals and derivatives, and business profits. The revenues are accumulated in a "Superfund" to finance clean-up or removal of inactive or abandoned hazardous waste sites.

Although product charges lack actual incentive impact, the revenues they raise finance (sometimes considerable) parts of policy measures designed to deal with the harmful environmental effects of the products on which charges are imposed; indeed, product charges are an efficient tool to raise revenue. Unfortunately, charge levels are, in most cases, too low to curtail consumption of the goods in question. Administrative efficiency is not a problem for product charges since they are implemented through existing tax or excise systems.

Administrative Charges. These charges are implemented in Australia, Belgium, Denmark, Finland, Germany, the Netherlands, Norway, Sweden and the United Kingdom. Belgium,

Denmark and Finland impose registration/control fees, while the other countries impose product licence fees. In Belgium, the charge is collected upon registration of imported and exported waste but the revenues are not earmarked for environmental purposes. In Denmark, the charge is levied on producers and importers of pesticides; revenues are used to cover expenditures for approval and control. Norway's and Sweden's charges are general: in Norway, they are used to finance registration and control in fish farming, agricultural pollution, emissions and licensing of chemicals, while in Sweden they are used to finance expenditures for authorization and control of car exhaust regulations.

Administrative charges are, by definition, connected to regulatory measures. Therefore, their aim is not to substitute themselves to regulation but to facilitate control measures. Their acceptability is good as long as they are not set at levels that are perceived to be too high. Since they are used to finance licensing and control, administrative charges are redistributive, transferring part of the financial burden to polluters and away from taxpayers. However, they do not cover control and damage costs entirely.

7.3.1.5 Other Instruments

The "Other Instruments" category includes a number of instruments that cannot be classified as either debt, taxes, subsidies or charges. In addition, revenue-generating potential varies greatly among these instruments. Innovative arrangements for the use of "other instruments" include the following:

- fines and penalties;
- compensation payments;
- public and private environmental funds;
- public/private sector partnerships; and
- non-profit/charitable organizations.

Fines and penalties, whether they are administrative or judicial, are imposed primarily for violations of requirements or regulations. Fines and penalties collected through environmental programs are generally imposed on polluters that continually fail to comply with regulations. Their main objective is to generate positive incentives rather than generate revenue.

Compensation payments are sums of money elicited from polluters through legal action. The proceeds are usually dedicated to environmental projects such as hazardous waste site clean-up.

Private and public and environmental funds are financed through lottery revenues, voluntary contributions by individuals, corporations, etc. Monies collected in these funds are generally dedicated in their entirety to environment protection and improvement, habitat restoration, conservation and protection of nature preserves, endangered species and wildlife.

Private/public sector partnerships are contractual arrangements between a public and private partner that commits both to providing an environmental service. Public authorities enter into such arrangements for a number of reasons, which include: access to more advanced technologies; cost-effective design; construction and/or operation; flexible financing; delegation of responsibility and risk; and guaranteed cost. Services sought include contract services, turnkey facilities, developer financing, privatisation and merchant facility.

Non-profit/charitable organizations sometimes initiate fund-raising activities and/or recruit volunteers in order to support local remedial activities or face emergency situations.

Evidence on the use of "other instruments" is almost exclusively available for the United States. In that country, recent survey results reveal that there were 71 programs in the "other instruments" category; these programs generated approximately $600 million annually. These programs are grouped in a category called "unclassified" programs. More that 50 percent of them can be described as either penalties or fines, while the remainder include revenues from lottery sales, private contributions, investment income, loan repayments, etc. Nearly 100 percent of the revenues from other instruments are dedicated to specific environmental programs. There is limited evidence available for Canada. Specific experience with the use of "other instruments" is discussed below.

Fines and penalties. While these instruments are currently used in the United States, their applications in the context of environmental programs are too numerous to list here. However, creative ways to use fine proceeds have made substantial contributions to state environmental programs in some instances. In 1977, Allied Chemical Corporation was fined US$13.2 million for polluting the James River (Virginia) with Kepone. Since the court encouraged the firm to use the fine to benefit the people of Virginia, Allied made a voluntary contribution of US$8 million to start the Virginia Environmental Endowment. The Endowment supports research and projects aimed at solving current environmental problems and preventing future ones. In 1988, the U.S. Environmental Protection Agency (EPA) fined the Commonwealth of Massachusetts and the Metropolitan District Commission nearly US$2.5 million for discharge violations at two wastewater treatment facilities. It was established that these discharges were responsible for significant pollution in the Boston Harbor/Massachusetts Bay area. The court ordered the Commonwealth and the Commission to deposit US$2 million from the fine into the newly-established Boston Harbor-Massachusetts Bay Environmental Trust Fund. According to the settlement, funds have to be allocated to remediation programs for polluted salt marshes and wetlands, beach clean-up and monitoring efforts, and pollutant transport studies.

Compensation Payments. In the United States, the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund) is the prime example of an innovative arrangement to obtain compensation payments. Under the Act, the Superfund can hold liable for clean-up costs any individual, business or corporation that contributed refuse to an hazardous waste site. The reach of the law extends to any kind of legal entity, including municipalities, insurance companies and even banks (through property owned through foreclosure). Thus far, approximately 60 hazardous waste sites have been cleaned at an average cost of US$30 million. The fund totalled US$5.5 billion in 1990. In Canada, the Province of Ontario has introduced Bill 220 on June 28, 1990. This Bill contains amendments to the Environmental Protection Act and Ontario Water Resources Act and constitutes a piece of

legislation similar to the U.S. Superfund. The main implications of this new legislation are the following:

- liability for environmental clean-ups can now be imposed on both present and previous owners and occupants of contaminated (with either hazardous or non-hazardous waste, or both) property; and

- the Ministry of the Environment can undertake clean-up work an send the property owner the bill. It can even add the costs to municipal taxes.

The Ontario government is currently seeking $100 million in damages for putting out and cleaning up the Hagersville, Ontario tire dump fire. The province is seeking $50 million in general damages and $50 million in special damages. A statement of claim filed with the provincial court has named the dump owner, the teenagers who caused the blaze, a construction firm and a trust company as defendants. No further evidence is available yet on the number of sites or potential financial implications of Bill 220.

Public and Private Environmental Funds. In the United States, examples of public environmental funds include the Minnesota Environmental and Natural Resources Trust Fund, the Ohio Natural Areas and Wildlife Checkoff, and the Virginia Nongame Wildlife Program Contribution. The Minnesota Environmental and Natural Resources Trust Fund is financed by the proceeds of a state lottery. A half of the proceeds are dedicated to the fund at least for the first five years and the money is devoted to the improvement and protection of the state's natural resources and environment. The Ohio Natural Areas and Wildlife Checkoff program is financed through individual donations made by surrendering a portion or the entirety of one's income tax refund. Contributions are used to finance protection of nature preserves, scenic rivers and endangered species, and/or protection of nongame and endangered wildlife. Finally, the Virginia Nongame Wildlife Program Contribution program in a way similar to Ohio's program. Its proceeds are dedicated to conservation and management of endangered species and other nongame wildlife.

In Canada, Ducks Unlimited, Friends of the Environment Foundation and the Shell Environmental Fund are examples of private environmental funds. Ducks Unlimited's fund is used to finance protection, maintenance and rehabilitation of environmentally sensitive sites such as marshes, swamps and wetlands. Its budget amounts to $50 million a year, from which 35 percent is used for on-site projects. Donations to the fund come from individuals, corporations, land and banquets. The Friends of the Environment Foundation is administered by Canada Trust on a local basis. The fund is used for local community initiatives such as park and stream clean-up, tree planting and education. The fund is financed by current and future Canada Trust customers and matching contributions by Canada Trust. The Trust contributes up to $1 million per year for new sign-ups. In addition, special bank accounts contribute 1 percent of interest earned to the local chapter of the fund; these contributions are matched by Canada Trust up to $2 million nationally, for each year. Finally, the Shell Environmental Fund is used to finance action-oriented projects such as park clean-up, wildlife habitat restoration, establishment of collection points for recycling, etc. The annual budget of the fund is provided by Shell and totals $1 million; the budget is used to finance projects whose costs range from $50 to $5000.

Public/Private Sector Partnerships. Examples of public/private sector partnerships at the municipal level in the United States are numerous and more than 20 case studies are currently available.[12] In 1987, the city of Mt. Vernon, Illinois faced compliance problems with wastewater treatment regulations and pressure to attract industry. It sought assistance from a local private firm to design, build and operate an upgraded and expanded wastewater treatment plant. The private partner completed the upgrade and expansion in substantially less time and saved the city approximately US$3 million (32 percent) compared to the Mt. Vernon's initial pay-as-you-go plan. In Westmoreland County, Pennsylvania the Municipal Services Authority wished to regionalize local systems, acquire additional systems and extend service to communities without service. The authority contracted with American Commonwealth Management Services for operation and maintenance of the county's drinking water system. Improved management has led to system expansion coupled with industrial and residential growth. In addition, higher bond rating facilitated the acquisition of a number of small water systems. This project was initiated in 1943. In 1985, Communities in the Worcester, Massachusetts area formed a committee to find a regional solution to waste management problems; studies suggested that the area had solid waste disposal needs that were not met and a market for energy. In a merchant agreement, the communities in the area accepted Wheelabrator's offer to build, own and operate a resource recovery facility (mass-burn incinerator). The Town of Millbury, Massachusetts offered the site for the facility. In exchange, Millbury is enjoying free tipping for 20 years and is receiving a fee for wastes bought from other communities. The Borough of Downington, Pennsylvania, owned a wastewater treatment plant that needed upgrading and expansion. The borough was surrounded by several younger, growing communities that created pressure for new facilities. To avoid political conflict and facilitate growth in the area, the borough and surrounding townships agreed to form a new authority with the power to enter into a public-private agreement.

Non-Profit/Charitable Organizations. In Canada, Kiwanis clubs have recently set up environmental committees. These committees operate locally and support initiatives such as the distribution of composters, production of books on the environment, education and scholarships. Clubs are also interested in supporting park and highway clean-up activities in the future. The Club's activities are financed by television auctions and various fund-raising events. While no dollar figures are available, other information suggests that the funds raised are not dedicated to the environmental committee. No U.S. evidence on non-profit/charitable organizations is available.

7.3.2 Advantages and Disadvantages of Funding Mechanisms

7.3.2.1 Debt

Debt is a practical financing tool for small State and local governments that cannot generate sufficient revenues to finance large capital improvements on a short-term basis and secure

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[12] U.S. Environmental Protection Agency, *Public-Private Partnership Case Studies: Profiles of Success in Providing Environmental Services*, Washington, D.C.: U.S. Government Printing Office, September 1990.

subsidies. Arrangements such as the use of revenue bonds have some advantages over other types of bonds: on the one hand, revenue bonds have more issuance restrictions and require increased reporting; on the other hand, their issuance does not require voter approval and they are, "typically not counted against a state's self-imposed borrowing cap."[13] Revenue bonds are therefore more attractive politically than general obligation bonds.

However, there are several major issues that need to be considered in the use of debt financing. First, debt is an impersonal financing tool and as such does not provide any incentive to users of the environment to economize on the resource. Second, debt financing implies borrowing now and paying later. This has implications for intergenerational impacts. Debt may imply spreading the burden of repayments and servicing over more than one generation. If this is the case two factors need to be considered. Under the principles espoused with the alternative funding mechanisms it is important that costs and benefits are allocated appropriately between polluters, users and beneficiaries both form intra- and inter-generational points of view. Debt financing does, however, provide the advantage of spreading the costs and benefits of an asset with an economic life of more than one generation. Again, however it is important that the method of financing the asset is made consistent with the appropriate allocation of costs and benefits between different stakeholders. Third, the comparative advantage of debt use has changed considerably in the last 5-10 years. During that period, private and public indebtedness have increased and have been perceived as a new and serious problem. Therefore, debt is becoming harder to sell politically. This is even more so in the context of deficit (and sometimes debt) reduction efforts that are currently being made by a number of governments in the OECD. Fourth, debt is vulnerable to economic fluctuations and its financing cost can become a significant burden in periods of high interest rates coupled with sluggish economic growth.

7.3.2.2 Taxes

Among all taxes, income taxes generally have the best potential for generating large amounts of revenue. Income taxes are thus particularly attractive for the purposes of financing projects that necessitate large capital and operation and maintenance expenditures over their useful lives, such as RAPs. Property taxes are an administratively simple means to collect revenue, although their revenue-generating potential is substantially less than that of income taxes. Finally, specific commodity taxes such as taxes on polluting fuels, tires and other goods generate revenue on a transaction basis at a relatively low administrative cost. However, their revenue yield is tied to economic performance. In addition, income taxes can be made more equitable through various provisions in the tax code, such as tax credits.

The disadvantages specific to each type of tax are the following: the collection of income taxes entails high administrative costs; commodity taxes (in the absence of a system of tax credits that provides compensation to the least well off individuals) are regressive; and property tax revenues may not be a reliable source of funding in communities that do not use Tax Incrment Financing (TIF) but grow rapidly while assessed property values lag behind market values. In

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[13] E. Shields, *Funding Environmental Programs: An Examination of Alternatives*, Washington, D.C.: National Governors' Association, 1989, p. 28.

general, as a source of funds for projects such as water and wastewater infrastructure and RAP, taxes have a number of drawbacks:

> First, it is difficult for the taxpayer to make a "conceptual linkage" between payment of tax and receipt of the service being financed. This, in turn, leads to taxpayer dissatisfaction, even when the beneficiary of the service is the same person who paid the tax. Second, taxes do not measure the demand for the service since there is no correlation with consumption. As a result, consumers will tend to use more of the service than is economically efficient. Third, water officials have to compete for a limited pool of tax revenues with several other public interest expenditures.[14]

The above is true for any environmental resource. It also highlights the advantages of user charges over taxes: first, charges are specific to the resource being consumed and therefore constitute a better signal of value to users; second, charges measure demand (or depend on a measurement of demand) and thus can be set at levels that bring the market closer to the level of socially efficient use; third, charges do not compete with a pool of general tax revenue whose use is likely to be influenced by a variety of pressure groups; and finally, charges are administratively cheaper since they involve fewer transactions in both collecting funds and allocating them to projects. Property taxes appear to be the most widely used tax-based funding mechanism for water and wastewater projects.

Within the context of taxes as a financing mechanism, the advantages of TIF are twofold: first, cities with little government aid from other levels of government or with fixed tax rates still can invest in infrastructure; second, TIF allows for tax revenue transfers to new projects or types of projects by including specific projects in the general finance base of the government, even when tax rate increases are unlikely or not feasible politically. However, the main disadvantage of TIF is that the elimination of the earmark on funds generated by the scheme sets aside revenue for which other agencies or projects may compete.

In the same context, exactions suffer from two principal shortcomings: first, they are only feasible politically in economically strong local economies. If pushed too far, they can encourage residential and industrial development to locate elsewhere; second, they are not equitable among users since they have nothing to do with the cost each individual user imposes on the infrastructure. Given the above conditions and international experience, general income taxes such as the personal income tax are clearly incompatible with the PPP. Sales taxes and other taxes on transactions are also incompatible with the PPP unless they are levied on sales or transactions involving polluting inputs or products (outputs). International experience with taxes as a financing mechanism shows variable adherence to the PPP in practice. Taxes are incompatible with both the User-Pay Principle and the Beneficiary-Pay Principle.

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[14] Wade Miller Associates, Inc., *The Nation's Public Works: Report on Water Supply*, National Council on Public Works Improvement, May 1987, p. 151.

7.3.2.3 Subsidies

The main advantage of subsidies is that they are a convenient financing mechanism, specially for the beneficiaries of the programs they support. In addition, subsidies can induce managerial practices to move towards prevention. A good example of this is public funding of municipal sewage systems with separate sewage and runoff, prior to urban expansion. Yet, there appear to be advantages in reducing the use of subsidies since there is evidence that:

> Removing subsidies may also prove effective in reducing environmental degradation. In sectors already favoured by heavy government subsidies, the removal of these may prove the most powerful mechanism for reducing the consumption of environmentally sensitive resources. In many instances, large government subsidies have encouraged the harvesting of renewable resources on a scale far beyond what would have occurred with the unimpaired operation of market forces.[15]

Another very important feature of subsidy schemes in the context of the current environmental debate is funding. On the one hand, subsidies financed by the general budget or revolving funds appear to be more acceptable politically than those financed by charges whenever the former are accompanied by regulation. On the other hand, subsidies financed by the general budget or revolving funds are less equitable than those financed by charges since the former involve parties that are unrelated to the problem. The cross-subsidization resulting from subsidy schemes is therefore inefficient and inequitable. It is inefficient because subsidies do not provide direct market signals and incentives to those who should receive them and because it is costly to redistribute money. It is also inequitable because those who pay for the subsidies are generally not the users, beneficiaries, nor responsible for the problems observed.

Innovative arrangements to provide subsidies illustrate their disadvantages. Revolving funds are not equitable since they substitute a cross-subsidy for direct subsidies (or grants). In addition, they are not efficient since the administrative burden of revolving funds even exceeds that of grants. Subsidized market loans and credit enhancements will not be equitable unless users, as opposed to taxpayers, repay loans. They can be particularly inequitable if taxpayers actually provide funds to expand subsidized and inefficient services to users. Worse, they can increase taxpayer exposure if financial institutions use the implied government guarantee to undertake ventures that are riskier than those they would undertake on their own.

Given the above conditions and international experience, the compatibility of subsidies with the PPP can be summarized as follows: subsidies that do not meet the OECD conditions outlined in the section on the Polluter-Pay Principle or that are funded by the general budget and revolving funds are not considered compatible with the PPP. However, subsidies financed from charge revenues and aimed at achieving levels of abatement superior to those of direct regulations are judged to be compatible with the PPP. Experience with subsidies shows that they are considered in line with the PPP because of the exception status of polluters. However,

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15 B. Hull and A. St-Pierre, *The Market and the Environment: Using Market-Based Approaches to Achieve Environmental Goals*, Report No. 62-90, The Conference Board of Canada, October 1990, p. 19.

adherence to the PPP is far from perfect since some schemes currently in operation are partially financed by the general budget and only a fraction of the costs are recovered from polluters. If the general public benefits through a subsidized abatement effort, such subsidies would be compatible with the Beneficiary Pay Principle. Subsidies are clearly incompatible with the User-Pay Principle.

7.3.2.4 Charges

User charges constitute a price assigned to the good or service being used. Thus, the advantage of charges is that they convey the unambiguous signal to users that the amount paid is tied to the amount of resource used and can, therefore, discourage excessive resource use. Consequently, charges are an appropriate tool in ensuring an efficient allocation of resources since those users who are the most willing to pay for the resources consume more while those who are less willing to pay consume less. Also, as mentioned above, charges have additional advantages: (i) they measure demand (or depend on a measurement of demand) and thus can be set at levels that bring the market closer to the level of socially efficient use; (ii) they do not compete with a pool of general tax revenue whose use is likely to be influenced by a variety of pressure groups; and (iii) they are administratively cheap since they involve fewer transactions in both collecting funds and allocating them to projects than taxes do, for example.

The disadvantages of charges include problems with political resistance and equity. The political resistance problem derives from the fact that users facing new charges will have a stronger incentive to oppose the charges than the broad group of users as a whole will have to support the charges. This is especially true of industrial users, who are often able to organize powerful lobbies to oppose measures that will cost them money. On the equity side, it is contended that charges are regressive in that they impose a proportionally heavier burden on economically disadvantaged populations. Such a concern refers directly to the concept of distributional equity. It may be argued, however, that users should pay charges that are related to the economic costs their demands impose on the system. The latter concept of economic equity, unlike that of distributional equity, is perfectly compatible with the concept of economic efficiency that is characteristic of properly set user charges.

Given the above conditions and international experience, charges are, as an economic instrument, compatible with both the PPP and the User-Pay Principle. More specific international experience suggests that effluent and user charges are generally in line with the PPP. Compatibility of product charges with the PPP is good on the whole since only the consumers of the products on which charged are imposed pay for the damage or preventive measures to be effected. Administrative charges are compatible with the PPP, although not to a full extent since they do not cover control and damage costs entirely. Charges are also compatible with the Beneficiary-Pay Principle.

7.3.2.5 Other Instruments

The advantage of other instruments is that their use increases education and public awareness towards the environment. In addition, these instruments exhibit a number of advantages: fines and penalties provide incentives to comply with regulations and are viewed as equitable since they are imposed for violations of acceptable operating practices. Fines and penalties thus

adhere closely to the PPP; compensation payments will be equitable only if established liabilities are in line with actual responsibility for damage. However, their efficiency will remain unaffected by the distribution of the liability burden; public and private environmental funds ensure that revenues from specific sources are used only for specific purposes (i.e. revenues are dedicated). Environmental funds and non-profit/charitable organizations involved in local clean-up initiatives or emergency situations are mainly financed through voluntary contributions; in other words, they are based on the donor's ability to pay. While they will not be economically equitable, they will improve distributional equity; finally, public/private sector partnerships are institutional arrangements that generally improve efficiency by saving costs, using better technologies, etc.; however, their consequences on economic equity are diffuse. In general, privatization and the establishment of merchant facilities will improve equity, while the establishment of contract services, turnkey facilities and developer financing will have minor (positive or negative) impacts on equity.

Other instruments have several disadvantages: fines and penalties are mainly incentive mechanisms (provided that they are set at level high enough to act as deterrent) rather than a revenue-generating instruments. In addition, most fine proceeds are put into general funds instead of being dedicated; compensation payments that result from institutional arrangements such as the U.S. Superfund incur very high transaction costs due to massive lawsuits. Although the revenue-generating potential associated with compensation payments is large, they constitute a relatively inefficient means of raising revenue; public and private sector environmental funds are inefficient because they are expensive to administer. In addition, those funds financed through lottery revenues are distributionally inequitable because they are regressive. Other instruments, taken individually or as a whole, cannot be considered as reliable, steady and predictable sources of funds.

Given the above conditions and international experience, none of the other instruments, apart from fines, penalties and compensation payments, can be considered compatible with the PPP. Other instruments will not be compatible with the Beneficiary-Pay Principle except in the case of environmental funds that finance habitat restoration, protection of endangered species, etc. that provide a direct benefit to contributors to the fund, such as individuals who enjoy fishing, hunting and wildlife in general.

7.3.3 Application of Funding Mechanisms to RAPs

This section provides a synthesis of the previous three sections leading to applications of funding mechanisms to RAPs. It presents a menu of cost allocation principles within which all the appropriate compatible funding mechanisms are listed along with possible specific applications to categories of remedial actions. Some funding mechanisms appear under more than one cost allocation principle as the three principles are not mutually exclusive with respect to compatible mechanisms. The relevant categories of remedial actions are: sewage treatment plant upgrading; industrial point source control; urban runoff control; agricultural non-point source control; sediments; habitat restoration; and mitigative action. Appropriate funding mechanisms for these remedial actions will be listed in that order.

7.3.3.1 Funding Mechanisms Compatible with the Polluter-Pay Principle (PPP)

The instruments that are compatible with the PPP and that can be considered as appropriate funding mechanisms for RAP purposes--given the previous discussion of advantages and disadvantages-- include: subsidies financed from charge revenues and aimed at achieving levels of abatement superior to those of direct regulations (or any subsidy, provided that it satisfies OECD's conditions outlined in the section on the Polluter-Pay Principle); charges; and compensation payments.

Subsidies. The examples that follow are relevant application of subsidies to RAPs:

- Grants or corporate income tax allowances (whichever is the cheapest to administer) to industries to encourage the adoption of new and more sophisticated abatement technologies and equipment to reduce industrial point source pollution beyond what is required by existing standards;

- Grants or tax allowances (whichever is the cheapest to administer) to farm operators to encourage the adoption of new and more sophisticated abatement technologies and equipment to reduce agricultural non-point source pollution beyond what is required by existing standards;

Charges. The examples that follow are relevant application of charges to RAPs. In each example, the party making a financial contribution is assumed to be contributing to pollution.

- Point source effluent charges for industries to finance industrial point source pollution control and habitat restoration activities;

- Product charges on water-intensive cooling and manufacturing technologies and equipment to finance industrial point source pollution control and habitat restoration activities;

- Urban runoff (stormwater) effluent charges for residential, commercial and industrial property owners to finance urban runoff control and habitat restoration activities;

- Non-point source effluent charges for farm operators to finance agricultural non-point source pollution control activities; and

- Product charges on fertilisers and pesticides to finance agricultural non-point source pollution control and habitat restoration activities.

Compensation Payments. The examples that follow are relevant application of compensation payments to RAPs:

- Compensation payments from past and/or current owners of industrial property to finance sediment removal activities; and

- Compensation payments from past and/or current owners of agricultural property to finance sediment removal activities;

7.3.3.2 Funding Mechanisms Compatible with the User-Pay Principle

Charges are the only instrument that is compatible with the User-Pay Principle. Therefore, under this cost allocation principle, charges will be the only mechanisms considered for RAP funding purposes. The examples that follow are relevant application of charges to RAPs:

- Effluent charges for industries to finance sewage treatment plant upgrading and industrial point source control activities;
- Effluent charges for farm operators to finance sewage treatment plant upgrading and agricultural non-point source control activities;
- Water and Wastewater user charges for residential, commercial and industrial customers to finance sewage treatment plant upgrading;
- Extra strength sewage user charges for industrial customers to finance sewage treatment plant upgrading;
- Sewage treatment plant development charges for residential, commercial and industrial property owners to finance the provision of water and wastewater services in new developments;
- Stormwater user charges for residential, commercial and industrial property owners to finance urban runoff control activities (including stormwater infrastructure);
- Stormwater development charges for residential, commercial and industrial property owners to finance the provision of stormwater services in new developments; and
- Aquatic (conservation or recreational) facility user charges to finance habitat restoration activities;

7.3.3.3 Funding Mechanisms Compatible with the Beneficiary-Pay Principle

Charges appear to be the only instrument that is compatible with the Beneficiary-Pay Principle. Therefore, under this cost allocation principle, charges will be the only mechanisms considered for RAP funding purposes. Since the benefits accruing to beneficiaries are mostly intangible (i.e. improved hygiene conditions, disease prevention, enhanced aesthetic and physical enjoyment of aquatic facilities and wildlife), it is suggested that the revenues generated from this cost allocation scheme be dedicated to remedial actions whose benefits are intangible or benefit to all groups in society. The examples that follow are relevant application of charges to RAPs:

- Beneficiary charges on residential, commercial and industrial property owners in areas in which sewage treatment plant upgrading takes place, in order to finance mitigative activities;

- Beneficiary charges on residential, commercial, and industrial property owners in areas in which urban runoff control activities take place, in order to finance mitigative activities; and

- Beneficiary charges on residential, commercial, and industrial property owners in areas in which habitat restoration activities take place, in order to finance mitigative activities.

7.4 PRELIMINARY CONCLUSIONS

The basic financing options available to RAPs are essentially the same as those available to water utilities. While the priorities for the latter involve planning and managing water and wastewater systems to meet user needs, the former's first and foremost priority is of a curative (or remedial) nature. Nonetheless, because many of the actions considered in RAPs are similar to those utilities undertake to meet demand pressures on their systems, RAP funding and financing can be addressed through many of the economic and financial instruments available to utilities and for the purposes of environmental protection.

Internationally, the trend in the use of financing mechanisms to provide financing for environment-related projects has been moving away from mechanisms based on the general budget (e.g. general income taxes, grants) and in the direction of charges and towards the application of the PPP. In this respect, Canada is lagging behind almost all OECD countries and locates somewhere in the middle of the spectrum of traditional versus innovative mechanisms. While user charges for water and household solid waste are currently in use in Canada, a very large proportion of all environmental programs in the country are funded by subsidies (grants). In turn, most of these grants are funded by the general budget (i.e. taxes).

The economic evaluation of alternatives suggests that the RAP financing framework should include a system of appropriately based charges. Charges that are appropriately based should fully recover costs from responsible parties (polluters, users or beneficiaries) according to either the costs they impose on environmental resource, or the benefits they derive from it. Such a framework for RAP financing should be designed to be efficient and equitable. In addition, its acceptability will be improved if it is seen as a system that simply imposes a fee for a service.

7.4.1 Summary Table of Cost Principles and Funding Mechanisms

The following tables provide a summary of the major advantages and disadvantages of the cost principles and funding mechanisms discussed in this chapter.

Cost-Allocation Principle	Advantages	Disadvantages
Polluter Pay	Economically Efficient Economically Equitable International Standard (OECD)	High costs to some polluters may cause closures
User Pay	Economically Efficient Economically Equitable	Requires measurement of environmental good or service use
Beneficiary Pay	Economically Efficient Economically Equitable May be Fairer than User pay when benefits extend beyond simple use	Beneficiaries and benefits they receive may be difficult to identify and measure
Funding Mechanism	**Advantages**	**Disadvantages**
Debt	Practical for lower-level governments that cannot generate enough revenues	Does not act as an incentive to economize on resources Can introduce some intergenerational inequities Poor choice economically given current indebtedness of governments Vulnerable to economic conditions Incompatible with PPP, UPP
Taxes	Good revenue-generation potential Low administrative costs (specific taxes) Act on incentives(specific taxes) Generally compatible with PPP (specific taxes)	Revenues tied to economic performance High administrative costs (general income taxes) Do not act as economic incentives (general income taxes) Generate economic distortions Incompatible with UPP Politically sensitive given current taxation levels

Funding Mechanism	Advantages	Disadvantages
Charges	Economically efficient and equitable Discourages excessive resource use Measures demand Generally compatible with PPP, UPP and BPP	May be regressive Politically unpolpular
Subsidies	Convenient for beneficiaries May induce practices that move toward prevention Consistent with BPP if general public benefits	Removal may be effective in reducing environmental degradation Rarely generates incentives to economize on resources Economically inefficient and inequitable Funds used to finance subsidies carry administration cost Incompatible with PPP, UPP
Other Instruments	Educate and increase awareness towards the environment Equitable when based on ability to pay (voluntary contributions to funds)	Low revenue-generation potential Not efficient nor equitable economically in general Administrative costs are often high May be regressive Not reliable, steady nor predictable as a source of funding Generally incompatible with the PPP, UPP, and BPP

8.0 A FRAMEWORK FOR CASE STUDIES

8.1 INTRODUCTION

This chapter proposes a framework for the comprehensive development of case studies concerned with the application of funding mechanisms to RAP sites. Ideally, such a framework would be applied in evaluating specific funding proposals. In light of budgetary constraints, implementation of case studies in this project has been significantly limited in comparison with this framework. Chapter 9 outlines the more limited case study approach taken, and reports on the major findings.

8.2 CASE STUDY EVALUATION CRITERIA

Three cost allocation principles were developed and discussed in the previous chapter: Polluter-Pay, User-Pay and Beneficiary-Pay. These principles would form the primary focus for the case studies of Metropolitan Toronto, Hamilton Harbour and the Bay of Quinte.

A comprehensive case study approach would examine and compare the cost allocation principles in terms of seven key criteria:

- identification and bounding of user groups;
- nature of allocable costs;
- funding mechanism feasibility;
- implementation and administrative cost;
- market impacts;
- social impacts; and
- cost-effectiveness.

8.2.1 Feasibility Evaluation

The first three criteria can be categorized as feasibility tests. The first criterion asks whether individuals within the groups identified under each cost allocation principle can be identified in practice. In addition, this criterion asks whether these groups can be bounded. That is, to what extent can the groups be made distinguishable from each other and from the rest of society in general. Users, for instance, will typically be more easily identified than beneficiaries. Municipalities will vary in the capability of their administrative systems, and mechanisms may have to be developed to ensure full and unambiguous coverage of each group.

The second criterion asks whether sufficiently rigorous accounting and cost identification systems exist to support the allocation of costs to the individual groups identified under each cost allocation principle. Unless the means exist to provide rigorous and supportable cost allocations, a funding mechanism will be difficult or impossible to devise and justify. The test

is whether systems exist, or can be developed reasonably easily, to identify individual members of the group so as to direct funding mechanisms appropriately.

The third criterion seeks to examine whether appropriate means exist to monitor costs and apply funding mechanisms or whether the municipality can technically accommodate such methods (e.g. various forms of metering, effluent monitoring, etc.).

8.2.2 Cost of Applying Funding Mechanisms

The fourth criterion pertains to the resources necessary to develop, implement and maintain systems for identifying individuals or groups, allocating costs to them, and apply funding mechanisms. These required resources would need to be assessed for each case study. The costs of applying funding mechanisms should constitute a reasonably low percentage of revenues raised, according to some appropriate standard.

8.2.3 Economic Impacts

The next two criteria pertain to the assessment of economic impacts. It is important to note that the economic benefits of remedial activities are not to be examined in the case studies. "Market impacts" refers to the estimated sensitivity of demand for environmental goods and services with respect to their price, for each group. These values reflect the impact that funding mechanisms will have on demand and thus revenues generated. The impacts come from the fact that funding mechanisms such as charges and taxes affect the relative prices of environmental goods and services, and other goods and services. The market impacts of each approach will vary depending upon the mix of polluters, users and beneficiaries in each case study region. Literature reviews and local surveys would be needed to estimate these critical values.

Social impacts refer to the income distribution implications of each funding mechanism, which in turn will depend upon the mean income of polluters versus users versus beneficiaries. Tests of regressivity and progressivity need to be applied for each approach in each case study region.[1] Social impact analysis also examines the ease with which groups with special needs can be isolated and treated differently under each approach.

8.2.4 Cost-Effectiveness

The information developed above permits a cost-effectiveness assessment of applying a particular funding mechanism. Cost effectiveness can be assessed in terms of the marginal cost of implementing the RAP activity and compared to the cost of applying the funding mechanism. In other words, if the costs associated with the planning implementation and administration of the funding mechanism are high relative to the costs of cleanup, it does not make economic sense to proceed with that mechanism.

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[1] The implications of full (and partial) cost recovery need to be examined for the purpose of assessing social impacts.

8.3 CASE STUDY FRAMEWORK

8.3.1 Process

The case study process should involve five stages as identified in Figure 8-1. These stages are:

- definition of the three RAP sites;
- identification and selection of the relevant RAP activities by site;
- application of the cost allocation principles to each activity;
- identification of the case study criteria; and
- implementation of the case studies.

Each of these will be discussed in turn.

8.3.1.1 Selected RAP Sites

The first stage involves the identification of the RAP sites that will be used for the case studies. For example, the following sites were pre-selected for actual implementation of the case studies:

- Metropolitan Toronto;
- Hamilton Harbour; and
- The Bay of Quinte.

8.3.1.2 Identification and Selection of Activities by Site

The next stage in the process is to identify the particular RAP activities that apply to the three sites selected.

From the eight RAP activity areas detailed in the cost estimation in Chapter 2.0, six potential RAP activity areas are applicable to these sites:

- Sewage Treatment Plants;
- Industrial Point Source;
- Urban Runoff (Combined Sewer Overflow and Stormwater);
- Agricultural Non-Point Source;
- Sediments; and
- Other Remedial Activities.

Figure 8-1: The Case Study Process

As far as the selection of the relevant RAP activities by site is concerned the cost updates in Chapter 2.0 identify which RAP activities are relevant to the three selected sites. In addition to this, the three RAP documents also identify RAP activities relevant to their own sites. There is only one activity which both our cost updates and the RAP documents have not identified as a concern. This is:

- industrial point source in Toronto.

This will be, therefore, excluded from the analysis.

It is also clear, however, that the RAP activities are of very different orders of magnitude of costs of remediation i.e., some activities are of greater significance than others in terms of the costs of remediation. In the selection of activities by site, therefore, we would differentiate between remediation activities by site which cost more or less than $10 million.

Figure 8-2, therefore, identifies the selected activities by site as one of three possible levels:

- identified in both our cost estimates and the RAP document and significant i.e., remediation costs are more than $10 million
- identified in both our cost estimates and the RAP document but are less significant i.e., remediation costs are less than $10 million
- identified in the RAP document but significance is unknown.

8.3.1.3 Application of Cost Allocation Principle

The third stage in the process is to apply the cost allocation principles to the selected activities/sites. There is no reason, at the outset, to exclude any of the three cost allocation principles - polluter pay, user pay, beneficiary pay - from an analysis of potential application to each of the RAP activities. For all of the activities each of the principles could be deemed to apply. For the purposes of the case studies the three principles are defined as follows:

- polluters: those who create the need for a remediation activity
- users: individuals, households or firms which for personal consumption, as part of some industrial process, or other consumptive "use" are users of the water resource e.g., households consumption of water or firms that use water for an industrial process or for cooling purposes.

FIGURE 8.2: RAP Activity by Site

RAP ACTIVITY	RAP SITE		
	Metropolitan Toronto	Hamilton Harbour	Bay of Quinte
Sewage Treatment Plants	●	●	●
Industrial Point Source		●	*
Urban Runoff	●	●	●
Agricultural Non-Point Source	●	*	●
Sediments	?	*	?
Other Remedial Activities	*	*	●

Legend:
- ● Significant
- ? Significance Unknown
- * Less Significant (less than $10 million)

- beneficiaries: those individuals or groups who use the water or waterfront to engage in activities such as fishing; swimming; boating; camping; boating; other leisure activities.

The case studies should also consider a combination of the principles, rather than dealing with each one separately, where this is appropriate. An example would be the grouping together of all activities for the user pay and beneficiary pay principles.

8.3.1.4 Case Study Criteria

The fourth stage is to assess each of the activities/principles for each of the three RAP sites against the seven criteria identified earlier.

Identification and bounding of groups

The identification and bounding of groups requires two steps for each activity/principle at each site:

- identifying who and /or what the groups are
- providing some measure of "size" of the groups.

For the polluter pay principle the first step requires that it must be possible to identify who are the polluters. This is easier to define where there are existing metering/monitoring systems in place, e.g., sewage treatment tied to metered use of water for households, or the nature of the pollution /contamination of the water can be clearly tied to polluters e.g., specific industrial or agricultural pollutants.

For the user pay principle the existence of metering systems for the use of water will assist in the definition of user groups. Where this is not the case, e.g., use of water directly from lakes or rivers, the possibility of developing other surrogate measures should be investigated.

For the beneficiary pay principle it should be possible at all three of the sites to discern who are the beneficiary groups since information is readily available on leisure activities at the sites.

A measure of size of the groups is important from two perspectives:

- how many are in the group; and

- within the group what are the levels of cause, use and benefits by individual members of the groups.

Thus, for example, it is important to assess not only how many industries may be responsible for industrial point pollution but also the extent to which each industry is contributing to the pollution. Metering and monitoring will provide a measure of this; if this is not available other surrogates such as some measure of industrial process should be investigated.

The **outputs** from the assessment of this criteria for each of the sites and for each (or a group of) activity and principle should be:

- definition of the groups that can be identified and bounded;
- estimate of the size of the groups; and
- differences related to size within the groups.

Nature of allocable costs

The case studies should determine whether cost accounting, administrative or other cost identification systems exist, or can be developed, to facilitate the allocation of costs under the principles in question.

In the case of sewage treatment plants and the polluter pay principle, for example, it is expected that for water/wastewater metered systems, the allocation of costs to users should be easier than where a pricing system unrelated to the level of use is in place. Similarly, costs can be allocated to individual firms on the basis of metered water intake; if this does not exist then other surrogate measures should be investigated related to production processing, energy consumption or any other appropriate indicators.

A system for the allocation of costs to beneficiaries, however, is likely to pose greater problems. While beneficiaries may impose some costs related to water quality it is unlikely that this would be a major part of the costs in question.

The **outputs** from the assessment of this criterion for each of the sites and for each (or a group of) activity and principle should be:

- identification of the extent to which costs can be allocated to groups; and
- indicative methods for the allocation of these costs.

Funding mechanism feasibility

It is necessary to determine whether the costs associated with each activity can be appropriately monitored and whether the funding mechanisms can be effectively applied. An examination of practical concerns in the monitoring of costs and technology concerns should be conducted. Certain existing technology, such as that for metering water/wastewater systems, is already in place in several municipalities in Ontario. This technology generally permits the monitoring of costs. Other technologies such as the monitoring of effluent discharges should be examined.

In the case of the application of the funding mechanism the key issue is the collection of charges that are imposed on polluters, users or beneficiaries. In the case of beneficiaries some method of collecting related to use should be investigated e.g., use of beaches; fishing and boating activities.

The **outputs** from the assessment of this criteria for each of the sites and for each (or a group of) activity and principle should be:

- the extent to which costs can be monitored; and
- the feasibility of applying funding mechanisms for the collection of charges.

Implementation and administrative cost

The cost of planning, implementing and operating/maintaining the system necessary for the identification, monitoring and allocation of costs to individuals or groups should be estimated. With existing technology, such as water meters, the costs can be derived with relative certainty -- user charges using metered water/wastewater systems, for example, have already been effected in several Ontario municipalities. Even with well-developed technology, however, administrative and other costs may be difficult to estimate.

The **outputs** from the assessment of this criteria for each of the sites and for each (or a group of) activity and principle should be:

- definition of all of the costs, by category, necessary to implement and administer the funding mechanisms.

Market impacts

The impact of the selected funding mechanism on the demand for goods and services - both environmental and non-environmental - must be assessed. This necessitates, where possible, producing elasticity estimates for the consumption of the various goods and services. These should be of two kinds:

- those directly related to the consumption of water quality goods and services; and
- those indirectly related through the impact of such charges on the final prices of goods and services.

The second category is difficult to quantify within the context of the present case studies. There are two ways in which manufacturing companies can deal with an additional pollution charge:

- reduce profitability; and
- pass on the additional cost in the price chain, either wholly or in part.

In the context of this type of study, only indicative information on theses indirect impacts can realistically be expected.

The elasticity estimates are important for their impact on the potential revenues to be generated from the funding mechanisms. The higher the price elasticity of demand the greater the impact on revenue reduction.

There is a considerable body of literature which has estimated the price elasticity of demand for water related services; these studies have refined elasticity estimates for both residential and industrial users. These should be the main source of information on elasticities in our case studies with site price and demand information being developed, where possible, within the case studies.

The **outputs** from the assessment of this criteria for each of the sites and for each (or a group of) activity and principle should be:

- estimated price elasticities of demand; and
- estimates of the impacts of these elasticities on the potential revenues to be collected under each funding mechanism.

Social impacts

The earlier discussion of this criterion stated that the major social impact to be assessed is that on income distribution. Even if there is some aggregate information available by site on income distribution, however, it is unlikely that a differentiation of the incomes of different groups or within activities will be possible.

Another means of differentiating social groups is possible. In the case of polluter pay and user pay, for example, a simple two group approach may be appropriate - industry/commercial and household. In the case of beneficiary pay differentiating between different groups of beneficiaries, e.g., beach users, fishermen, boaters, may be appropriate.

The **outputs** from the assessment of this criteria for each of the sites and for each (or a group of) activity and principle should be:

- an estimate of the impacts of each funding mechanism on each of the defined social groups.

Cost-effectiveness

This is the final step in the application of the criteria. It compares the costs of remediation with the combined **incremental** costs of the following:

- planning, implementing, operating and maintaining the system for applying the funding mechanism; and
- the losses in revenue (resulting from the elasticity impacts) which the new funding mechanisms may bring about.

The **output** from the assessment of this criteria for each of the sites and for each (or a group of) activity and principle should be a comparison of the costs of remediation with the combined cost of implementation/administration and revenue losses resulting from the application of new funding mechanisms.

8.3.1.5 Examination of the Case Studies

In this section we identify some of the issues which are discussed in the RAP documents which provide a starting point for the differences between the three RAP sites in the case studies. These factors should be confirmed, amplified or amended, as necessary, based on work undertaken in the case studies.

Metropolitan Toronto

Sewage Treatment Plants. These are the largest source of nutrients, metals and organics. They are not significant, however, for their effect on the bacteria loading on the beaches, on fishing activities or on the quality of drinking water.

Urban Runoff. The principal beneficiaries are swimmers due to pronounced impact caused by discharge of bacteria. It also degrades wildlife and habitat due to conveyance of pollutants and contribute to sediments. Polluters are both residential users and industry (both local and remote).

Sediments. The bacteria in sediments can contribute to the pollution of beaches.

Other Remedial Activities. The beneficiaries include offshore fishery, sports fishery, boating and windsurfing, swimming.

Hamilton Harbour

Hamilton and Burlington Sewage Treatment Plants. These are the main source of ammonia and a major source of phosphorus.

Industrial Point Sources. The main contributors are the Stelco and Dofasco Steel Plants, particularly as sources of ammonia.

Sediments. Again the Stelco and Dofasco Steel Plants with major sources of iron and other heavy metals.

Urban Runoff. This is a major source of ammonia, phosphorus, bacteria and a source of PCB's transported from local industry.

Harbour Uses. The major potential uses of the harbour are for recreational boating; fishing and swimming. Swimming is not currently permitted, however, because of unacceptable water quality standards; the number of potential swimmers (latent demand) has been estimated using national participation rates in this activity.

Bay of Quinte

Agricultural Non-point source. The primary cause is poor management of milkhouse and livestock wastes and direct access of livestock to watercourses.

The beneficiaries at this site include commercial fishery, walleye sport fishing, recreational boating, swimming, water skiing, camping, shoreline property owners. Latent demand for swimming is estimated at 12,000 per season.

8.3.2 Overall framework

The overall framework for the case studies is shown in Figure 8-3. This shows their four dimensional nature relating to sites, activities, pricing principles and criteria.

Figure 8-3: Evaluation Framework

9.0 CASE STUDY IMPLEMENTATION

9.1 INTRODUCTION

As stated in the previous section, the case study results presented here will only address a limited number of the criteria discussed above. They are intended to indicate how various stakeholders would be affected under certain RAP funding scenarios, for the ultimate purpose of assessing the feasibility of such scenarios. In particular our purpose here is to estimate incremental impacts in terms of:

- cost per representative stakeholders; and
- rate charged per unit of pollution/use/benefit.

The estimation process involved several steps. First of all, the economic profiles of Toronto, Hamilton and Bay of Quinte RAP regions were examined to identify potential stakeholders among:

- households;
- commercial establishments;
- industry; and
- agriculture.

Data was then obtained on

- number in each class of stakeholders;
- volumes of pollution/use/benefit for each stakeholder;
- current tax burdens;
- comparison variables (e.g. average household income); and
- behaviourial responses (e.g. demand elasticities).

A set of per-stakeholder and per-unit estimates of cost impact were then constructed with this data. Data sources are listed in Annex F.

9.2 CASE STUDY ESTIMATES

9.2.1 Funding Scenarios

Resource limitations dictated that the number of funding scenarios be restricted in scope. The scenarios listed below were selected in consultation with MOE officials. This process entailed the selection of the RAP actions to be considered, the funding principle to be applied and the allocation of cost among stakeholders. Figure 9-1 lists the funding scenarios for which estimates have been constructed.

FIGURE 9.1: Funding Scenarios

RAP SITE	ACTION	FUNDING PRINCIPLE
Metropolitan Toronto	Sewage Treatment/CSO	User Pay
	Habitat Restoration	Beneficiary Pay
Hamilton Harbour	Sewage Treatment/CSO	User Pay
	Industrial Point Source Control	Polluter Pay
	Sediment Removal	Polluter/Beneficiary Pay
	Habitat Restoration	Beneficiary Pay
Bay of Quinte	Agricultural Non Point Source Control	Polluter/Beneficiary Pay
	Sewage Treatment/CSO	User Pay

9.2.2 STP/CSO Costs

Figure 9-2, Figure 9-3, and Figure 9-4 present results for STP/CSO costs under the user-pay principle for the three RAP sites. Two sets of results are presented in each case: in the first it is assumed that users are required to cover the entire annualized cost of STP/CSO upgrades, whereas in the second a provincial contribution equivalent to 33 percent of capital costs is assumed.[1]

For Toronto and Quinte, CSO was calculated by subtracting an estimated stormwater component from the Urban Runoff entries in Table 2.3. In each case the stormwater component was calculated by multiplying the stormwater area reported in Table 2.2 by $25,000.

For Hamilton, the maximum stormwater cost figure reported in the December 1991 Draft RAP document was subtracted from the corresponding Urban Runoff figure to give estimated CSO costs.

Several per-household measures are presented in each instance. "Total Annual Cost/Household" is based on the assumption that the total annualized costs of STP/CSO upgrades are imposed on households, whereas "Use-Based Total Annual Cost/Household" assumes that a share of costs equal to the household share of municipal water usage is imposed on households.[2] Data on "Current Total Annual Cost/Household" are provided for purposes of comparison with incremental costs.

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[1] This assumption was used on the advice of MOE officials, and is an estimate of the provincial contribution if existing grant criteria were applied for the cases examined. It should be noted that in practice the provincial contribution tend to vary with the size of the municipality. In particular, the funding assistance for capital expenditures on communal sewage and water works is provided according to the following principles:

- Large municipalities may receive an amount equal to 15 percent of eligible costs after deduction of federal or other grants; funding may be increased to one third of eligible costs for that part of the work necessary to solve health or environmental problems.

- Small municipalities may receive an amount equal to 33.33 to 85 percent of eligible costs after deduction of federal or other grants. Communities with a population of 1,000 or less receive the maximum grant of 85 percent; those with a population of 7,500 receive the minimum grant of 33.33 percent; communities with populations between 1,000 and 7,500 receive a grant determined according to the formula:

  Grant = 93 Percent - 0.008 of Population.

It should also be noted that the Province might wish to examine the criteria and level of their grants if a beneficiary-pay scenario were used.

[2] The sectoral breakdown of municipal water use applied here is an average for Ontario.

Figure 9.2: Toronto: STP Cost Allocation under User-Pay

STP/CSO Costs - Toronto	
Capital Cost	$2,370,000,000
Total Annual Cost (1)	$378,379,311
Use-Based Household Share	
of Total Annual Cost (2)	47%
Use-Based Household Cost	$177,025,615
Use-Based Industry Cost	$201,353,696
Estimated Municipal Water	
Use Per Household (CM)	663
Number of Households	1190745
Total Annual Cost/Household	$318
Use-Based Cost/Household	$149
Current Cost/Household (4)	$234
Total Annual Cost/CM	$0.48
Total Annual Cost/CM (3)	$0.96

(1) Includes annual O & M costs of $100 M.

(2) Proportion of municipal water use due to domestic use. Based on averages for Ontario presented in Tate Lacelle, 1987.

(3) Includes price response, assuming price elasticity of -0.5

(4) Cost based on total municipal water and sewage billings

STP/CSO Costs - Toronto	
Capital Cost	$2,370,000,000
Total Annual Cost (1)	$286,514,138
Use-Based Household Share	
of Total Annual Cost (2)	47%
Use-Based Household Cost	$134,046,286
Use-Based Industry Cost	$152,467,852
Estimated Municipal Water	
Use Per Household (CM)	663
Number of Households	1190745
Total Annual Cost/Household	$241
Use-Based Cost/Household	$113
Current Cost/Household (4)	$234
Total Annual Cost/CM	$0.36
Total Annual Cost/CM (3)	$0.73

(1) Includes annual O & M costs of $100 M. Assumes a provincial contribution equivalent to 33 percent of capital costs.

(2) Proportion of municipal water use due to domestic use. Based on averages for Ontario presented in Tate Lacelle, 1987.

(3) Includes price response, assuming a price elasticity of - 0.5.

(4) Cost based on total municipal water and sewage billings

Figure 9.3: Bay of Quinte: STP Cost Allocation under User-Pay

STP/CSO Costs - Bay of Quinte		STP/CSO Costs - Bay of Quinte	
Capital Cost	$54,500,000	Capital Cost	$54,500,000
Total Annual Cost (1)	$8,801,550	Total Annual Cost (1)	$6,689,038
Use-Based Household Share of Total Annual Cost (2)	47%	Use-Based Household Share of Total Annual Cost (2)	47%
Use-Based Household Cost	$4,136,728	Use-Based Household Cost	$3,143,847
Use-Based Industry Cost	$4,664,822	Use-Based Industry Cost	$3,545,191
Estimated Municipal Water Use Per Household (CM)	663	Estimated Municipal Water Use Per Household (CM)	663
Number of Households	50166	Number of Households	50166
Total Annual Cost/Household	$175	Total Annual Cost/Household	$133
Use-Based Cost/Household	$82	Use-Based Cost/Household	$62
Current Cost/Household (4)	$45	Current Cost/Household (4)	$45
Total Annual Cost/CM	$0.26	Total Annual Cost/CM	$0.20
Total Annual Cost/CM (3)	$0.53	Total Annual Cost/CM (3)	$0.40

(1) Includes annual O & M costs of $2.4 M.

(2) Proportion of municipal water use due to domestic use. Based on averages for Ontario presented in Tate & Lacelle, 1987.

(3) Includes price response, assuming a price elasticity of - 0.5.

(4) Cost based on total municipal water and sewage billings

(1) Includes annual O & M costs of $2.4 M. Assumes a provincial contribution equivalent to 33 percent of capital costs.

(2) Proportion of municipal water use due to domestic use. Based on averages for Ontario presented in Tate & Lacelle, 1987.

(3) Includes price response, assuming a price elasticity of - 0.5.

(4) Cost based on total municipal water and sewage billings.

Figure 9.4: Hamilton Harbour: STP Cost Allocation under User-Pay

STP/CSO Costs - Hamilton Harbour	
Capital Cost	$448,150,000
Total Annual Cost (1)	$76,269,531
Use-Based Household Share of Total Annual Cost (2)	47%
Use-Based Household Cost	$35,682,872
Use-Based Industry Cost	$40,586,659
Estimated Municipal Water Use per Household (CM)	663
Number of Households	204944
Total Annual Cost/Household	$372
Use-Based Cost/Household	$174
Current Cost/Household (4)	$213
Total Annual Cost/CM	$0.56
Total Annual Cost/CM (3)	$1.12

(1) Includes annual O & M costs of $23.6 M.

(2) Proportion of municipal water use due to domestic use. Based on averages for Ontario presented in Tate & Lacelle, 1987.

(3) Includes price response, assuming a price elasticity of - 0.5.

(4) Costs based on total municipal water and sewage billings.

STP/CSO Costs - Hamilton Harbour	
Capital Cost	$448,150,000
Total Annual Cost (1)	$58,898,486
Use-Based Household Share of Total Annual Cost (2)	47%
Use-Based Household Cost	$27,682,288
Use-Based Industry Cost	$31,216,198
Estimated Municipal Water Use per Household (CM)	663
Number of Households	204944
Total Annual Cost/Household	$287
Use-Based Cost/Household	$135
Current Cost/Household (4)	$213
Total Annual Cost/CM	$0.43
Total Annual Cost/CM (3)	$0.87

(1) Includes annual O & M costs of $23.6 M. Assumes a provincial contribution equivalent to 33 percent equivalent of capital costs.

(2) Proportion of municipal water use due to domestic use. Based on averages for Ontario presented in Tated & Lacelle, 1987.

(3) Includes price response, assuming a price elasticity of -0.5.

(4) Costs based on total municipal water and sewage billings.

Note: Capital Costs were annualized over a twenty year period at a rate of 10%.

These figures also give estimates of incremental cost per unit of municipal water usage ("Total Annual Cost/CM"). (No distinction between households and other sectors is made here.) Two estimates of this type are provided in each instance. The first of these simply divides total annualized costs into estimated water usage.[3] This approach does not take the possibility of price-induced curtailment of usage into account, and for this reason it likely underestimates the additional charges that would be required to generate required revenues. A second per-unit estimate takes this factor into account: it assumes that demand for water usage is characterized by a price elasticity of - 0.5. The selection of this parameter value was based on a review of existing water demand studies.[4] Note that a price response of this size has the effect of doubling the required per-unit charge relative to the case of no price response.

It is apparent from the results presented here that RAP-related costs are significant relative to current household costs even under a use-based allocation of total STP/CSO costs. To provide further perspective, Figure 9-5 gives data on average household incomes in the RAP sites. Figures are provided for the totality of households (under the heading of "TOTAL")[5] and households receiving the provincial family benefit allowance (under the heading of "FBA Recipients").[6] Generally speaking, RAP-related costs amount to considerably less

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3 Estimates of water use were derived from data on average use per capita in Ontario. Since these data reflect the overall levels of industrial and commercial use in the province they may have only limited applicability in the case of Quinte.

An alternative per unit cost impact measure is annualized cost per unit of sewage processed. Data for the Toronto RAP site yields an estimated incremental charge of $0.46 per cubic meter, assuming no price response. This compares to the estimated additional charge of $0.39 per cubic meter of water usage given in Figure 9.2.

4 Empirical studies of water demand have produced a broad range of price elasticities. There does seem to be general agreement that demand is price inelastic, so that additional charges will produce additional revenue (that is, curtailment of use will not be sufficient to offset the direct effects of such charges on revenue). Brooks, Peters and Robillard give -0.24 to -0.40 as a range characterizing available price elasticity estimates for the household sector in Canada. A broader survey by Lewis and Haney suggests a somewhat higher range for both residential and industrial demand. Taking all of this into account, an aggregate price elasticity of - 0.5 seems reasonable.

5 These are nominal figures for 1989. The income concept used here is money income, as defined by Statistics Canada. This "is the sum of receipts accruing to individuals as compensation for present or past employment (earnings, pensions), plus all government transfer payments (family allowances, old age pensions, unemployment insurance, etc.) plus yields from investments (interest, dividends) including rental income...".

6 These figures include income from all sources. They were derived from monthly averages, and in this respect ignore turnover among FBA recipients: strictly speaking, these figures should be interpreted as the average annual income to households receiving FBA benefits throughout the relevant year.

than one percent of overall average annual household income in the RAP areas, and between one and four percent of the average annual income of FBA recipients.[7]

Figure 9-5: Average Household Income

	Average Household Income	
	TOTAL	FBA Recipients
Toronto Rap		
Metro Toronto	$68,191	$10,956
Regional Municipality of Peel	$63,465	$11,280
Regional Municipality of York	$74,788	$10,860
Hamilton RAP		
Hamilton-Wentworth	$55,852	$11,052
Quinte RAP		
Hastings County	$51,957	$11,196
Lennox and Addington County	$45,811	$11,976
Prince Edward County	$43,753	$11,064

9.2.3 Agricultural Non-Point Source

Figure 9-6 presents results for Agricultural Non-Point Source costs for the Bay of Quinte RAP under both the polluter-pay and beneficiary-pay principles. The polluter-pay principle requires in this instance that the costs of remediation be borne by farm operators in the region. The figures given for "Total Annual Cost/Acre" and "Total Annual Cost/Farm" simply divide annualized costs into the relevant number of units in the RAP site. Under the polluter-pay rule a typical farm operator in the region would thus incur costs of $2,871 per year, or $14 per acre of farmland.[8]

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[7] It is to be expected that a disproportionately large number of FBA recipients will be renters and hence will not pay water charges directly. However, it is also to be expected that rents would eventually be adjusted to reflect any additional charges, and hence would be transmitted to FBA recipients.

[8] Data for # of farms and average farm acreage taken from 1986 Census of Agriculture. Number of beneficiaries is based on figures from "The RAP for Hamilton Harbour, Environment Canada," (Dec. 1991).

On the assumption that the beneficiary-pay principle requires that recreational users of waterways in the Quinte area bear the costs of remediation, Figure 9-6 also gives an estimate of the cost per user-day of recreational activity ("Total Annual Cost/User-Day"). This amounts to $42 per day. A daily charge of this amount might prove to be prohibitive for many potential recreational beneficiaries.

Figure 9-6 also provides a figure for "Total Annual Cost/Household". As suggested below, significant benefits may accrue to property-owners from the enhancement of recreational facilities and other elements of the local environment. In this respect it may be reasonable to impose some share of remediation costs on households under the beneficiary-pay rule. The figure presented in Figure 9-6 assumes that annualized costs are borne entirely by households. This yields a per-household figure of $52, which is roughly a tenth of one percent of average annual household income in the area.

Figure 9-6: Cost Impact: Agricultural Non-Point Source Cost Allocation under Polluter/Beneficiary Pay

Agricultural Non-Point Source Costs - Bay of Quinte	
Capital Cost	$22,000,000
Total Annual Cost	$2,584,112
Total Acreage	180,000
Number of Farms	900
Number of User-Days	62,101
Number of Households	50,166
Total Annual Cost/Acre	$14
Total Annual Cost/Farm	$2,871
Total Annual Cost/User-Day	$42
Total Annual Cost/Household	$52

9.2.4 Industrial Point Source

Figure 9-7 presents results for Industrial Point Source costs for the Hamilton RAP under the polluter-pay principle. Assuming that the total annualized costs of $38.2 million are borne entirely by the relevant firms, the estimated annual cost per cubic meter of industrial effluent ("Total Annual Cost/CM") is $1.96.

Figure 9-7: Cost Impact: Industrial Point Source cost allocation under Polluter Pay

Industrial Point Source Costs (1) - Hamilton Harbour	
Capital Cost	$240,000,000
Total Annual Cost (2)	$38,190,310
Average Annual Volume of	
Industrial Effluent (CM)	19,532,148
Total Annual Cost/CM	$1.96
(1) Includes only Stelco and Dofasco.	
(2) Includes $10 M annual O & M costs.	

9.2.5 Sediment Removal

Figure 9-8 presents results for Sediment Removal costs for the Hamilton RAP under both the polluter-pay and beneficiary-pay principles. Assuming that the total annualized costs of 17.6 million are borne entirely by the relevant firms, the estimated annual cost per cubic meter of industrial effluent is $0.90.

Figure 9-8: Cost Impact: Sediment Removal cost allocation under Polluter/Beneficiary Pay

Sediment Removal Costs (1) - Hamilton Harbour	
Capital Cost	$150,000,000
Total Annual Cost	$17,618,944
Average Annual Volume of Industrial Effluence (CM)	19,532,148
Number of User-Days	150,000
Number of Households	204,944
Total Annual Cost/CM	$0.90
Total Annual Cost/User-Day	$117.46
Total Annual Cost/Household	$85.97
(1) Includes only Stelco and Dofasco.	

Potential beneficiaries of this RAP action are both recreational users and households in general. The estimated "Total Annual Cost/User-Day" assumes that total annualized costs are borne entirely by recreational users: this gives a figure of $117.46 per day. The corresponding estimate of "Total Annual Cost/Household" is $85.97 per year, which is less than one percent of average household income in the area.

9.2.6 Habitat Restoration

Figure 9-9 presents results for Habitat Restoration costs[9] for both the Toronto and Hamilton RAP sites under the beneficiary-pay principle. Data on recreational use in the Toronto site could not be obtained, so an estimate of "Total Annual Cost/User-Day" is presented for only Hamilton. This amounts to $14 per day. Annual cost impacts are negligible for both RAP sites according to the alternative beneficiary-pay measure, "Total Annual Cost/Household".

Figure 9-9: Cost Impact: Habitat Restoration cost allocation under Beneficiary Pay

Habitat Restoration Costs - Hamilton Harbour	
Capital Costs	$13,500,000
Total Annual Cost	$1,585,705
Number of User-Days	150,000
Number of Households	204,944
Total Annual Cost/User-Day	$10
Total Annual Cost/Household	$8

Habitat Restoration Costs - Toronto	
Capital Cost	$1,270,000
Total Annual Cost	$149,174
Number of User-Days	NA
Number of Households	1,190,745
Total Annual Cost/User-Day	NA
Total Annual Cost/Household	$0.13

[9] Cost estimates for Habitat Restoration at these two sites are not directly comparable. Costs for Hamilton are based on the most current information from the Stage II Remedial Action Plan document. Current information on costs for Toronto are not yet available.

9.3 OTHER CONSIDERATIONS

Certain other considerations and refinements not covered by the estimates presented above are potentially important here. Several of these relate to factors that have been discussed in previous sections. These issues cannot be examined quantitatively without a significant amount of primary research, well beyond what is possible in the present study.

- To the extent that additional charges elicit behaviourial responses from those on which they are imposed, the distinction between short-run and long-run impacts may be important. Polluters/users/beneficiaries may be unable to avoid new charges in the short run due to their previous commitments (e.g. sunk investments in capital goods embodying certain technologies). In the long run, however, such charges may be avoided by using alternative technologies (e.g. water conservation through measures such as closed loop systems for cooling water in industrial operations), or by simply moving to another jurisdiction. Similarly, it may require some period of time before agents abandon long-established practices or fully grasp the cost implications of new charges. This may also cause long-run responses to be much more pronounced than those observed in the short run. If stakeholder responses to new charges change over time then revenues generated will be similarly affected. This clearly has implications for rate-setting.

- The nature of behavioral responses: substitution versus reduced activity. Will industry respond to new charges by shifting toward "cleaner" technologies or by cutting production and employment? Households may have the option of adopting water-saving technologies in response to a higher price of water. To the extent that such opportunities are available the overall impact on households of a given rise in price will be mitigated. More generally, the availability of opportunities to substitute new technologies for reduced activity is likely to influence the political reaction to additional charges.

- There are tax expenditure aspects of policies which induce industry to invest in pollution-control equipment. Since outlays on such equipment are given especially favourable treatment in current provincial tax policy, this may reduce the amount of revenue accruing to the province from corporate income tax.

- The introduction of new charges is likely to affect the market value of residential property, farm land, and existing industrial establishments. Losses of capital value of this sort, which may be substantial, will be largely borne by those who own such property at the time of introduction.

  On the other hand, a successful program of environmental improvement will yield amenities that raise property values. This consideration necessarily complicates the application of the beneficiary pay principle. If, for example, a remediation program produces a usable recreational facility in a certain

locality we might expect a large part of the benefit generated thereby to actually accrue to property-owners in the area, even those who do not value the new facility. This in turn suggests that a rigorous application of the beneficiary-pay principle would require an allocation of costs that includes this group of passive beneficiaries.

- Both behaviourial responses and capital value effects will be influenced by expectations. The effects of new charges on capital values and current behaviour (e.g. investment decisions) will depend on how these and other factors (e.g. technology) are expected to evolve. Additional charges that are perceived as temporary in nature are likely to elicit a less pronounced response than those thought to be permanent.

- Secondary effects. Industrial effluence charges will be borne directly by established enterprises. But this may also induce a substantial drop in local employment and regional out-migration. This is likely to induce a drop in the value of local residential property as a secondary effect. This might then be fairly described as an indirect cost of funding borne by property owners.

9.4 SUMMARY

Key results of the case studies are as follows.

- **STP/CSO[9].** Estimated total annual costs are $378.4 million for Toronto, $76.3 million for Hamilton and $8.8 million for Quinte. Under the user-pay-principle and including a provincial contribution equal to 33 percent of capital costs, the corresponding incremental costs per household are $241, $287 and $133, respectively.

- **Agricultural Non-Point Source Control.** Estimated total annual costs are $2.6 million for Quinte. This implies annual incremental costs of $2,871 per farm, or $14 per acre of farmland under a polluter-pay regime. Allocating cost according to the beneficiary-pay principle implies an additional charge of either $42 per day of recreational use or $52 per household.

- **Industrial Point Source Control.** Estimated total annual costs are $38.2 million for Hamilton. Assuming that these are borne entirely by Stelco and Dofasco, the annual cost per cubic meter of industrial effluent is $1.96.

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[9] For Toronto and Quinte, CSO was calculated by subtracting an estimated stormwater component from the Urban Runoff entries in Table 2.3. In each case the stormwater component was calculated by multiplying the stormwater area reported in Table 2.2 by $25,000. For Hamilton, the maximum stormwater cost figure reported in the December 1991 Draft RAP document was subtracted from the corresponding Urban Runoff figure to give estimated CSO costs.

- **Sediment Removal.** Estimated total annual costs are $17.6 million for Hamilton. This implies a cost of $0.90 per cubic meter of industrial effluent under a polluter-pay regime. Allocating costs according to the beneficiary-pay principle implies an additional charge of either $117 per day of recreational use or $86 per household.

- **Habitat Restoration.** Estimated total annual costs are $0.1 million for Toronto and $1.6 million for Hamilton. This implies a cost of $10 per day of recreation use in the case of Hamilton under a beneficiary-pay regime. Annual cost per household is negligible for each of Toronto and Hamilton.

ANNEX A: ANNOTATED BIBLIOGRAPHY

ANNEX A: ANNOTATED BIBLIOGRAPHY

In this annex we provide annotations of a number of key documents, articles and texts drawn from international experience which are of direct relevance to the development of innovative approaches to the identification and application of potential funding mechanisms for implementation of RAPs.

Anderson, F.R., and A.V. Kneese, P. Reed, R. Stevenson, and S. Taylor. Environmental Improvement Through Economic Incentives. (John Hopkins University Press 1977).

This text offers an in-depth discussion of charges as an economic incentive towards environmental improvement. Included is a survey of environmental quality management schemes employing the use of charges and direct regulation from a variety of jurisdictions in the U.S. and internationally, a discussion of monitoring problems and alternative monitoring methods, U.S. legislative powers and restraints, and the politics involved in the use of charges.

The text emphasizes the importance of reducing the total cost of pollution control. The greater the cost-effectiveness of the approach adopted, the lower the total bill society must pay for the achievement of environmental standards. Charges are favoured rather than direct regulatory approaches primarily due to their greater cost-effectiveness. Direct regulation, relying heavily upon centralized standard setting and enforcement, is vulnerable to inefficiency, enforcement difficulties, and unpenalized delay.

The text identifies three possible approaches to setting charge rates (pricing), and setting limits to the use of environmental resources. The survey component of the text covers charges as applied to air and water pollution, solid wastes, land use, noise, congestion, energy conservation, and hazardous substances. For each policy observed, the authors have described the purpose or goal of the system, economic variables providing the basis for computation of the charge rate, variability of the charge rate with environmental and economic factors, specific activities charges, use of charge revenues, administrative requirements, and charge system interaction with standards systems addressing the same environmental problems.

Apogee Research International Limited. Water and Sewer Financing in Ontario: Issues and Options. (Ontario: Ministry of Environment, March 1991).

The Apogee document examines the current state of municipal finance in Ontario with respect to the financing of water and sewer infrastructure, and it identifies approaches to financing water and sewers which may be applicable in the Province.

This document also examines in significant detail criteria for evaluating potential financing and administrative arrangements, and objectives that need to be defined for each municipality. These objectives are described as: 1) Rate of growth of community, 2) Impact on Real Estate Prices, 3) Fiscal Objectives, 4) Cross-subsidization, and, 5)Environmental and service standards. Specific criteria discussed for analyzing the various financing and administrative arrangements required are divided into three classes: fairness, market sensitivity, and administrative considerations.

Baumol, W.J., and W. Oates, The Theory of Environmental Policy. (Cambridge: Cambridge University Press, 1988).

This text provides a comprehensive analysis of the design of environmental policy. Included is a discussion of charges, marketable emissions permits, direct controls, taxes, and subsidies, as well as a discussion of international environmental issues, and the debate between establishing national or local standards for environmental quality. The text argues that charges and marketable emission permits can in principle achieve the desired environmental standards at the least cost to society. The choice between effluent fees and marketable emission permits is described to be dependent upon pertinent local circumstances. Where it is important to distinguish between individual pollution sources, permit systems appear to be more appropriate. Alternatively, where a uniform pricing system is satisfactory, a single effluent charge applicable to all sources becomes more appealing. The authors come to the conclusion that a mixed policy system of both taxes and direct controls is a less costly and more efficient means of achieving environmental objectives.

In terms of national and local standards for environmental quality, it is argued that imposing rigid, uniform, national standards is likely to come at a substantial cost. At issue is whether decentralized determination of environmental standards can be expected to realize these gains or if, instead, forces such an interjurisdictional competition for income and jobs will lead to an outcome still worse than that under uniform national standards. It is clear, however, that where pollutants travel over substantial distances (such as acid rain) the role of the central government is bound to remain.

Bertrand, F., MacLaren, J.W., and Peter Pearse. Currents of Change: Final Report on the Inquiry on Federal Water Policy. (Ottawa: Environment Canada, September 1985).

This comprehensive document assesses the adequacy of Canadian federal water policy and the capacity of Canadian institutions to respond to changing environmental circumstances. The report describes the constitutional responsibilities of the federal government and the legal framework it has adopted to meet its responsibilities in water management nationally and internationally, such as those described in the Canada Water Act and the Navigable Waters Protection Act. The adequacy of this framework in light of emerging environmental issues is assessed, and certain changes are recommended. Federal government organizational structure for fulfilling its responsibilities in water management, focusing on the role of Environment Canada is examined. The document makes significant use of information collected in public hearings and in consultations with provincial and territorial officials.

Blinder, A.S. Hard Heads, Soft Hearts: Tough-Minded Economics for a Just Society, (Reading, MA: Addison-Wesley Publishing Company Inc., 1987).

In this text, Blinder argues in favour of replacing current "command and control" environmental protection systems with market-based approaches such as marketable pollution permits or taxes on emissions. The two approaches are seen to be equivalent in economic terms, each can achieve the same amount of pollution reduction at the same cost. However, some political and administrative considerations are believed to render permits as the superior instrument. The author recognizes the required investment in monitoring equipment to implement this policy; situations where such policy is not workable, such as where sources of pollution are not readily identifiable are also examined. The text outlines the efficiency argument, or why emissions fees can clean up the environment at a lower cost than mandatory quantitative controls. It also tackles the argument that emission fees would be harder to enforce than direct controls. Other reasons cited in favour of marketable emissions permits is that firms in compliance with a mandatory standard have no incentive to reduce emissions further.

Commission for the European Communities. Proposal for a Council Regulation (EEC) establishing a Financial Instrument for the Environment (LIFE). (Brussels, January 1991).

As indicated by the title, this document formally proposes the establishment of financial instruments in the European Community as the most appropriate means for dealing with: environmental deterioration resulting from past activities; or, environmental damage where it is impossible to pinpoint the cause or person responsible.

The financial instrument would have four general objectives: 1) To help strengthen and increase the effectiveness of administrative structures or services designed to ensure the implementation of environmental provisions, 2) to help control and reduce the various forms of pollution by means of measures complementing action of a regulatory nature, 3) to help protect sensitive areas and maintain biogenetic diversity, and 4) to provide technical and financial support in third countries for the implementation of international conventions and for the resolution of common or global problems. The proposal provides a rationale for the use of financial instruments in light of its statement of support for the polluter-pay principle.

Department of the Environment. Issues and Options: Submission to the National Hearing of the Inquiry on Federal water Policy, (Ottawa: December 1984).

This submission by the Department of the Environment is comprised of a discussion of issues and options concerning: water quantity, water quality, water management uses and planning efforts, and jurisdictional issues. The report is descriptive in nature and focuses on the management aspect of federal water policy rather than a technical analysis of issues and options. In terms of water quality issues, the submission recommends that existing legislation be strengthened at the federal level to cover all components of the toxic cycle, including production, transportation, use and disposal. It also recommends that government assistance be provided to encourage the development of cheaper and better remedial and prevention/containment technologies.

Dobbs, Ian M. Litter and Waste Management: disposal taxes versus user charges. Canadian Journal of Economics (February 1991).

This paper suggests that there is a need to consider both private and social costs in letter and rubbish collection. The paper supports the idea of implementing a refund system or user subsidy for proper disposal of rubbish. The author has developed a market model in support of setting a disposal tax at the marginal social cost associated with littering, with a subsidy (negative user charge) for the 'proper' (non-littering) disposal of wastes set at the difference in social marginal costs as between littering and non-littering. Refundable deposits for beverage containers are cited as a special case of the disposal tax plus user subsidy in which the tax equals the subsidy.

Ecologistics Limited. Bay of Quinte Remedial Action Plan Socio-Economic Assessment of Proposed Remedial Measures. Technical Report No. 11, Ontario Ministry of the Environment, Policy and Planning, (December 1990).

This report is a technical report on the socio-economic makeup of the Quinte watershed and the water resource uses of the bay. An economic evaluation of Bay of Quinte Recreational

Fishing is also included. Remedial options, including tertiary treatment at WPCP's, treatment of direct industrial discharges to the Bay, elimination of direct urban storm water loads to the Bay, reduction of agricultural non-point source loads, and diversion of Lake Ontario Water via the Murray Canal are covered. The associated costs of each remedial measure are described and evaluated in strictly monetary terms, and their impact is assessed.

Environment Canada, Environment Ontario: Ministry of Natural Resources, Metropolitan Toronto and Region Conservation Authority. Metro Toronto Remedial Action Plan Environmental Conditions and Problem Definition. (September 1988).

This document summarizes environmental conditions and identifies environmental problems in the Metro Toronto Area of Concern. Also included in this report is recent information on the status of the aquatic environment, use impairment, sources of contamination and remedial measures underway and planned, such as the Municipal Industrial Strategy for Abatement (MISA), the Toronto Area Watershed Management Strategy (TAWMS), and the Metro Toronto Waterfront Water Quality Improvement Program (WWQIP).

Environment Canada, Metro Toronto Remedial Action Plan. Draft Discussion Paper on Remedial Options. (April 1990).

This document provides a detailed description of "Remedial Intents," including a problem summary and suggested action components to achieve the intents. The purpose of the document was to provide a basis for discussion within public hearings for the Royal Commission on the Future of the Toronto Waterfront as well as within the Public Advisory Committees.

Frahm, Annette, "Financing the Clean-Up of Puget Sound". EPA Journal. (November/December 1990).

This article outlines the use and success of various funding mechanism employed in cleaning up the Puget Sound in Washington state. Important funds such as cigarette taxes generated $2 million in grants over four years for the Puget Sound Authority. These funds were earmarked for local water quality projects; the state paying 50% of the cost for water quality facilities, such as sewage treatment plants, and 75% of the cost for activities such as planning and education. The creation of self-supporting municipal storm water facilities are discussed, along with private efforts to tap into federal financing programs. The article explains how the establishment of the Puget Sound Finance Committee to look into financing options has resulted in recommendations for a combination of taxes, and fees as new sources of funding.

Grover, Brian and David Zussman. Safeguarding Canadian Drinking Waters. Inquiry on Federal Water Policy (1985).

An overview of the state of Canadian drinking water, focused particularly on quality issues, the legislative and regulatory framework and relevant federal programs. Federal and provincial roles, and the issue of overlapping jurisdictions and joint government activities is discussed. The report identifies a lack of Federal focus on drinking water issues and strongly emphasizes the need for the federal government to cooperate with provincial and local governments in order to safeguard Canadian drinking waters.

Hahn, R.W. "Economic Prescriptions for Environmental Problems: How the Patient followed the Doctor's orders". Journal of Economic Perspectives 3: 95-114, (Spring 1989).

This paper focuses on the experience of environmental instruments, namely marketable or tradeable emission permits, charges, and market-based environmental programs. The author suggests that the capacity to monitor and enforce a particular system of permits or taxes can dramatically affect the choice of instruments, by examining case studies from four different countries.

The author also argues that the actual use/implementation of these tools tends to depart from the role which economists conceived for them, and that empirical evidence has shown that, "less than textbook" approaches to instrument implementation has resulted in a level of cost savings from charges and marketable permits that is generally far below their theoretical potential.

Hull, B. and A. St. Pierre. The Market and the Environment: Using Market-Based Approaches to Achieve Environmental Goals. Report No. 62-90, The Conference Board of Canada, (October 1990).

This report discusses how environmental considerations interface with the market economy and also provides a description of the principal types of market-based interventions such as taxes, charges, and user fees; market creation schemes such as permits and tradeable credits; deposit-fund systems, and investment incentives. Illustrations of the use of effluent charges, nitrate taxes, and tradeable air permits are provided. Taxes or charges may be applied in three different ways, with quite different effects. They may be applied to inputs, effluent/emissions, or final products. Advantages and disadvantages of each of these types of taxes are discussed in terms of their ability to achieve environmental goals. Although it is being further studied in a number of countries (including Canada), the use of tradeable emissions permits has so far been limited to a small number of programs in the United

States. Negative connotations attached to the introduction of the concept of the "right to pollute" have made the option a difficult political proposition.

LeMarquand, David, G. Boundary Water Relations and Great Lakes Issues. Inquiry into Federal Water policy (1985).

This paper presents an overview of water issues along the boundary with emphasis on the complexity of the quality issues of the Great Lakes. It details the nature of transboundary issues in terms of some political pressures and constraints that affect their resolution. Some of the main features of Canada-United States boundary water relations are reviewed, broadly classified as those in which there is some mutual incentive to cooperate and those in which there is no real advantage for one country to work with the other. Spillover issues, where communities on one side of the border only experience environmental damage, are especially hard to resolve. Some current Great Lakes problems are examined to provide a perspective on the problems and opportunities for cooperative management of boundary water resources. Factors such as population concentration, political structures and the declining importance of the Great Lakes as a centre of industrial power are discussed. The role, structure, authority and limitations of the International Joint Commission is discussed in some detail.

Loudon, Michael. Acceptability of Municipal User--Polluter Pay Panel at a Workshop on the User Pay Principle. Policy Studies Program, The Rawson Academy of Aquatic Science, Research Committee, The Canadian Water and Wastewater Association. (May 1990).

This document was the lead paper at a workshop sponsored by the two organizations listed above. It gives a brief but detailed treatment of: the appropriateness of user pay vs. taxation; water policy and conservation vs. economic principles; the practicality and efficiency of user pays methods; and the comprehension, awareness and acceptability of user pay by customers (the general public). Property tax is cited as being highly appropriate to local communities as it is the least costly to administer relative to the yield, and its certainty of collection coupled with virtual impossibility of avoidance. Taxation is thought to be ideal where a service such as police or fire protection is provided where it is not realistic or appropriate to measure and bill for its use. User pays is ideal where the amount used can be measured and there are no social or policy implications that support the taxation approach.

Lude, K.C. & Kilburn, T. Inventory of Ontario Provincial Funding Programs applicable to Remedial Action Plans (RAPs). Water Resources Branch, Great Lakes Section, Ministry of the Environment (January 1991).

This document provides a descriptive overview of provincial funding programs that have potential for use in the preparation and implementation of Remedial Action Plans (RAPs). Information includes objectives, participants, timetables, geographic areas covered, activities supported, funding methods, past and present annual allocations and expenditures and eligibility criteria of each program.

Muldoon, P. Water Conservation and the User Pay Principle: Whose Water is it Anyway? A Discussion Paper prepared for a Workshop on the User Pay Principle, The Rawson Academy of Aquatic Science and The Canadian Water and Wastewater Association (May 1990).

This paper, which was presented to a workshop on the User pay Principle, deals primarily with a rationale for the promotion of water conservation and options and opportunities for its achievement. Regulatory tools such as direct water regulation within municipalities, water audits for industry and private residences (identification of water inefficient appliances, leaking pipes, etc.), and water quality standards are outlined. Market approaches such as water use charges, effluent charges, and water rights allocation (tradeable) are examined. In the course of its discussion, the paper deals with jurisdictional issues surrounding the management and regulation of water. The paper also touches on "A Priori" rights to water and/or to its use, and the issue of whether or not user pay schemes legitimize undesirable behaviour or causes undue hardships for those who cannot afford it.

OECD Management Policy Group. Economic Instruments in Solid Waste Management. (1981)

A comprehensive examination of charges (user, product), deposit systems, financial assistance, and market creation, such as the creation of waste exchanges or market subsidizations. The section on charges addresses the calculation of charges and the factors this calculation is normally dependent upon, advantages of this instrument, possible systems and their application, equity, and efficiency.

Office of Water, U.S. Environmental Protection Agency. Discussion Paper on Alternative Financing mechanisms for state water programs. (November 1989).

This study examines the need for increased funding to support implementation of state program requirements under the Safe Water Drinking Act. It then identifies and lists the advantages of alternative financing mechanisms (state funding mechanisms other than general revenues and grants) that can be used, together with general revenues, to fund state water quality programs. It also describes several financial management options that are designed to maintain control over and provide flexibility in managing program resources. This

document provides brief examples of where financing mechanisms have been put into practice, and criteria for the evaluation of these financing options.

Ontario Ministry of the Environment, Policy and Planning Branch. Overview Economic Assessment of Remedial Action Plans for the Great Lake's Areas of Concern (including appendices). (April 1990).

This report provides a general framework for economic assessment of the RAPs, including an estimation of economic benefits resulting from the attainment of the four water quality objectives identified for the 17 Areas of Concern. The appendices of this report provide detailed cost estimates for each of the remedial action plans in the 17 Areas of Concern in the Great Lakes region.

Opschoor, J.B., and H.B. Voos, Economic Instruments for Environmental Protection. (Paris, OECD, 1989).

This text describes a number of environmental policy contexts, policy principles and choice of instruments used, drawing on six case studies from the United States, Sweden, Germany, France, Italy and the Netherlands.

The study included an analysis of instruments currently applied in the countries described above: charges, subsidies, deposit-funded schemes, market creation, and enforcement incentives. **Charges** consisted of: effluent charges, user charges, product charges, administrative charges and tax differentiation. In almost all cases, charges were not seen to be an optimal instrument in terms of reaching policy objectives. The charges system is seen as being the outcome of negotiations between those groups in favour and those parties against. A compromise is reached between these two parties that is normally too low to have any incentive impact. **Subsidies** consist of: grants, soft loans, and tax allowances. In general, subsidies are found to be incompatible with the "Polluter-Pays-Principle," but are used as an exception to this rule, most commonly during "transitional periods." **Deposit-fund** schemes are usually introduced by private companies; initially, this was done as a cost control mechanism. In general, the deposit-fund schemes are considered compatible with the "Polluter-Pays-Principle," administratively efficient, economically efficient, and practical as long as private companies maintain the systems that are required. **Market creation** may consist of emissions trading, market intervention, and enforcement incentives. In general, the emissions trading is a more efficient instrument of environmental policy than direct regulations. However, its practicality is low. Market intervention and enforcement incentives are rarely applied.

On average, a total of 14 instruments per country were reported to have been in operation in 1987. Charges were used most frequently (44 of 85 instruments), followed, subsidies (27) and 14 of the remaining instruments.

Pearce, David, Anil Markandya, and Edward B. Barbier. Blueprint for a Green Economy. The U.K. Department of the Environment. (Earthscan Publications Ltd. London 1989)

This text addresses economic instruments for ensuring sustainable development; the prices of goods and services and resources. The text supports the idea of developing pricing systems for environmental goods that have previously been treated as "free goods" with "zero prices." Full privatization of environmental resources is not seen as an option; the idea of 'modifying' markets of previously free services is explored. The authors point out that proper pricing of products and services should reflect the wider social costs of production, inclusive of any environmental services, so that price is equal to the marginal social cost. Included in the discussion is a definition of 'polluter' applicable to the Polluter Pay Principle, and an explanation of market based incentives such a charges and taxes.

Resources for the Future and the Centre for Environmental Studies, Public Economics and the Quality of Life. Lowdon Wingo and Alan Evans (eds.) (John Hopkins University Press, 1977).

This text is a collection of papers that were presented at the International Research Conference on Public Policy and the Quality of Life in Cities, convened in New Orleans in January of 1975. Of note is a paper entitled, "Property values and the benefits of Environmental improvements: Theory and Measurement." This paper discusses the concept of estimating changes in aggregate property values as a result of improvements in environmental amenities, as well as discussing property-owners' willingness to pay for these amenities. The paper discusses the development of a "Long-Run model of an Urban Area with Environmental Amenities" for describing the impact of these environmental amenities on property values.

Spellman, J.D,. "Environmental Needs Challenge the Global Marketplace". Europe (September 1989).

This article examines the use of market-based approaches to environmental remediation in selected European countries such as France, the Netherlands, and Germany. The approaches described consist of charges, deposit-fund schemes, creation of markets, and subsidies. The article presents some arguments as to how these approaches could be used in

the U.S. to spur on private-sector innovation and initiative in the pursuit of environmental quality.

Wishart, Jenifer. Creative Financing For Water and Wastewater Systems: Some Thoughts on Public Policy. Canadian Water and Wastewater Association Proceedings (1989).

This paper explores some new approaches to financing the rehabilitation and expansion of water supply and wastewater treatment systems. Included is a discussion of subsidized loans, proposals for credit enhancement, and reduction of municipal borrowing costs through either increased attractiveness of municipal bonds or debentures. The role of taxes such as levies on developers, benefit zones, and tax-increment financing which dedicates the revenues from a growing tax base to water and wastewater projects is also contained in this paper. Finally, demand management through conservation incentives and rate restructuring to redefine capital needs is explored.

ANNEX B: EXISTING PROGRAMS

ANNEX B: EXISTING PROGRAMS

1.0 PROVINCIAL PROGRAMS

1.1 MINISTRY OF AGRICULTURE AND FOOD

1) FOOD SYSTEMS 2002

Goals/Objectives: Assist growers to reduce their use of pesticides by 50% over a 15 year period.

Timeframe: 1988 - 2002

Activities Supported:

- Research: internal and solicited
- Technical Advice and Assistance: training and support of pest management specialists to assist farmers
- Education: through IPM and OPEP
  - farmer education/certification programs
  - field delivery and development

Funding Method: Research Grants

Resources:

- Budget for the first 5 years $10,000,000
  - Education $1,000,000/5 years
  - Solicited Research $800,000/year

Eligibility Criteria:

- Anyone is eligible to submit proposals for solicited research grants.
- Technical advice and assistance is available to farmers.

Comments: This program involves three 5-year terms. The second and third terms will provide funding for the implementation of projects that result from research as well as other projects.

2) INTEGRATED PEST MANAGEMENT (IPM) PROGRAM

Goals/Objectives: Combination of the use of specific pesticides and effective biological and cultural methods.

Timeframe: Annually funded

Activities Supported: Technical Advice and Assistance: Provides for the support of pest management advisers who monitor and compile information to assist growers and vendors; advisers also provide assistance on an individual basis; support is also provided for supplies to advisers.

Funding Method: Support for Ministry-employed pest advisors

Resources: Funding:
1988-89 $540,800
1989-90 $543,000

Eligibility Criteria:

- Any member of the public has access to information provided through this program, or to request advice on an individual basis.
- This program is restricted to the following crops: apples, peaches, pears, grapes onions, and carrots.

3) LAND STEWARDSHIP II

Goals/Objectives:

- Promotion of soil conservation farming techniques
- Promotion of integrated resolutions for on-farm soil and water resource problems
- Sustainable soil and water resources
- Raise level of awareness of conservation issues in the farm community
- Education of farm conservation practices, through on farm demonstrations. The program will also develop field level information which farmers need to make conservation planning decisions.
- Provide direct assistance to approximately 5,000 farmers

Timeframe: September 1, 1990 - 1994

Activities Supported:

- Farm conservation practices and plans
- Implementation of approved farm conservation practices and plans
- Promotion, education and demonstration, and adoption of conservation technology
- Evaluation of conservation technology and practices
- Eligible practices include: residue management, cover crop planting, erosion, sediment and water control structures, manure storage and transfer facilities, pesticide storage and handling facilities, milkhouse waste treatment facilities, tree windbreaks, fencing watercourses, and providing alternate livestock and watering facilities

Funding Method:

- Assistance of up to a maximum of 50% of the **reasonable** cost of implementing the approved soil conservation plan, or a component of the plan, is available, to a maximum of $10,000 per applicant. This maximum is reduced by an amount that reflects the grant the applicant received under the Land Stewardship Program and the Ontario Soil Conservation and Environmental Protection Assistance Program II.

Grants

- To farm organizations to provide local delivery of the farm conservation program.

Funding Method: Cost Sharing

- To enhance adoption of technology, cost sharing will be provided to farm organizations in cooperation with industry and universities for evaluation of conservation technology and practices in areas such as tillage, cropping, nutrient management and pest management.

Resources:

- Total budget over four years is $38 million. $10 million was used to fund the past Land Stewardship Program. Starting in April of 1991, $38 million will fund Land Stewardship II, over the course of three years.

- Component costs of the Land Stewardship program:

Farm conservation Planning	$ 1.2M
Extension and Technology Transfer	$ 2.8M
Financial Initiatives	$29.5M
Industry Self Direction	$ 3.3M
Administration	$ 1.2M

Eligibility Criteria:

- Landowners must complete a conservation farm plan consisting of an inventory of the soil and water resources on the farm and an action plan or list of options for addressing specified problems relating to the management and conservation of these resources. The plan must be approved by a local farm organization.

Priority/Selection None, other than first-come-first-serve.

Comments:

- Farmers may submit their soil conservation plans throughout the winter. Funding of projects will begin in April of 1991.

- Further information will be forthcoming and incorporated in the next update of this document.

4) ONTARIO PESTICIDE EDUCATION PROGRAM (OPEP)

Goals/Objectives: Provide a program of study on the safe handling and application of pesticides for both vendors and growers.

Timeframe: Annually funded

Activities Supported: Education: support for implementation and administration of pesticide education courses

Funding Method:
- Grants for development of programs.
- As fees are collected from those taking the courses, delivery of the program is self-supported.
- Food Systems 2002

Resources: Approximate Cost of Delivery:

1988-89 $360,000
1989-90 $395,000

Eligibility Criteria: This course is open to anyone.

Comments: Participation Results:

Year	Vendors	Growers
1988	220	1,500
1988-89	310	10,000
1989-90	200	10,000

1.0 MINISTRY OF THE ENVIRONMENT

1) CAPITAL AND DIRECT GRANTS PROGRAM FOR MUNICIPAL WATER AND SEWAGE INFRASTRUCTURE DEVELOPMENT

Goals/Objectives: To assist in the construction of water and sewage works facilities.

Timeframe: Annually funded

Activities Supported:

- Capital Costs: construction of water and sewage works facilities

Internal divisions of activities funded are as follows:

- Direct Grants
- Lifelines Study
- Lifelines Construction
- Beaches Improvements
- Private Systems Upgrading
- Salt Contamination
- Water Tank Rehabilitation
- WTP Optimization
- Provincial Water Projects
- Provincial Sewage Projects
- Regional Priorities (RPB)
- SPL Municipal Improvements
- Research and Development: water distribution and sewage collection systems technical Advice and Assistance
- Capital Costs: construction costs of communal water and sanitary sewage work; repair or upgrading of private wells and sewage disposal systems where repair is an acceptable alternative to construction of communal works; rural water pipeline extensions
- Other Costs: administration and legal costs

Funding Method: Grants

- Proportional grants and disbursements.
- Grants on net costs, determined after deducting all federal or provincial government grants.
- Communal Works:
  1) Population > 7500

-For major works designed to accommodate new development a grant assistance of 15 percent is available.
-For projects designed to resolve health or environmental problems grants will be based on 33 percent of the cost which can be attributed to meeting current requirements and 15 percent of the project cost which relates to the servicing of new urban development.

2) Population < 7500
-Where the municipality or community lies within a regional municipality, grant assistance is limited to 70 percent of the grant normally provided in accordance with the formula.
-33-85% calculated on the basis of population and range [grant = $93.00 - (P% 0.008)]

- Private Facilities: > 7500: Up to 33% < 7500: 33-85%
- Rural Water Pipelines, construction formula, not less than 33%
- Water Distribution, Rehabilitation, and Pollution Control Planning Studies, needs studies formula, not less than 50%.

Resources:

- Funding 1989 - 1990
- Regular Grants to Municipalities (W & S works) - $90 million
- Provincial Water and Sewage Projects (Disbursements) - $64.5 million
- Beaches Remediation - $30 million
- Infrastructure Rehabilitation - $12 million

Eligibility Criteria:

- All Ontario municipalities are eligible to apply.
- For local water distribution and sewage collection works, grants are subject to enactment and enforcement of Section 19 of the Municipal Act, requiring all property owners to connect to the system.
- For upgrading and repair the servicing of seasonal residences are not eligible.
- Rural water pipelines are subject to the approval of the Ministry of Agriculture and Food and the Ministry of Municipal Affairs.
- Community: An area to be serviced may be defined as a "community" for grant purposes if it meets the following criteria:

1) The residential density of the area in question is not less than 2.5 residences per gross hectare or in the case of strip development there are 35 residences per kilometre; and,

2) The area in question is spatially separated from the nearest "serviced community" by not less than 2 kilometres.

Priority/Selection Applied - projects are given individual 'project priority' evaluations.

omments: The Water Resources Branch administers the PCP studies aspect of this program while the capital support is administered by the Project Engineering Branch.

2) LIFELINES: INFRASTRUCTURE REHABILITATION PROGRAM (MUNICIPAL WATER IMPROVEMENT PROGRAM)

Goals/Objectives: To improve and protect quality of ground and surface waters and to maintain quality of drinking water in distribution systems.

Timeframe: Annually funded, grants paid in advance.

Activities Supported:

1) Studies (includes following types):
a) Pollution Control Planning Study includes: Inland lake studies, beach clean up studies, beach water pollution source survey and overflow control/stormwater treatment.
b) Sewage Collection System Needs Study.
c) Water Distribution System Needs Study.
Objective:

To identify deficiencies within the system and propose cost effective solutions to bring the system back to its original efficiency.

2) Rehabilitation:
a) Sanitary Sewer collection system.
b) Water Distribution System Rehabilitation Program.
Objective:

To correct the deficiencies identified in the Needs Study.

Funding Method: Grants
Not less than 50% and not more than 85% of study costs and 1/3 of rehabilitation costs.

Resources: Approximate Expenditures:
1987-88 $2,400,000
1988-89 $7,700,000

Funding: 1989-90 $8,500,000

Eligibility Criteria: All Ontario municipalities that have an existing water and sanitary works system are eligible to apply.

Priority/Selection Criteria: Some of the factors considered to prioritize the projects are as follows:
1) Physical Condition
2) Age
3) Benefit of the proposed work in reducing health risks and impact on environment
4) Cost effectiveness
5) Flow reduction

3) INDUSTRIAL WASTE DIVERSION PROGRAM

Goals/Objectives: To provide assistance to private companies undertaking industrial waste reduction, reuse, and recycling (3Rs) initiatives.

Timeframe: Annually funded

Activities Supported:

- Capital Costs: Waste diversion projects
- Operational costs: Start-up/commissioning costs
- Research and Development
- Demonstration/Evaluation
- Eligible Projects: generic feasibility studies; reduction, reuse, and recycling of wastes; process or equipment modification or evaluation; demonstration of technology; upgrading existing operations beyond current state-of-the-art for a particular industry; research

Funding Method: Grants

- Capital Costs - up to 50%
- Operational Costs - up to 50% for a defined time limit
- Research and Development and Demonstration/Evaluation - up to 100%

Resources:

Funding:

1988-89	$2,550,000
1989-90	$6,500,000
1990-91	$8,200,000

Eligibility Criteria:

- Ontario's industrial and commercial sectors
- Municipalities and private companies that are applying for assistance for a project that is being contracted out by a municipality are ineligible.

4) MUNICIPAL RECYCLING SUPPORT PROGRAM (MRSP)

Goals/Objectives: To assist municipalities with the planning, implementation and operation of recycling projects in their communities.

Timeframe: Annually funded

Activities Supported:

- Feasibility studies: consulting fees and other expenses
- Operational costs: wages, repair/maintenance, materials, services
- Capital costs: building construction and recycling equipment
- Household bins (blue boxes)
- Promotion and Advertising: design/implementation of a promotion strategy
- Demonstration: pilot projects
- Education

Funding Method:

- Grant support for 5 years
- Feasibility studies: up to 50%
- Operational costs: proportion of net operating cost on a declining percentage of gross operation expenses (year 1, 2, 3, 4, 5 → 50%, 40%, 30%, 20%, 10%)
- Capital costs: case by case
- Household bins: one per household with a maximum replacement of 2% per year
- Promotion and advertising: up to 50% to a maximum of $0.10 per capita per year
- Demonstration: up to 100%
- Education: up to $15,000, case by case

Resources:

Expenditures:
1986-87 $3,310,284
1987-88 $5,000,000

Funding:
1988-89 $7,700,000

(Note: there will also be revenues received for materials that are recovered and sold)

Eligibility Criteria:

- Education: private companies, educational institutions and individuals
- Operational and capital grants: non-profit recyclers
- Proposals must include the recycling of old newspapers plus 2 other materials.
- Proposals must demonstrate that significant market commitments have been obtained for the recovered materials.
- Multi-material source separation projects which are municipally endorsed and which demonstrate future financial viability are eligible.

5) MUNICIPAL REDUCTION/REUSE PROGRAM

Goals/Objectives: To assist municipalities, the private sector or others in implementing projects aimed at altering consumer-generation, treatment and disposal practices.

Timeframe: Annually funded

Activities Supported:

- Education: development and implementation of information strategies
- Capital Costs: equipment used to reduce waste requiring treatment or disposal (example: home composting)
- Promotion

Funding Method: Grants

- Up to 50% of promotion and capital costs
- Education - development of creative materials or approaches which may be funded up to a limit of $25,000 per project

Resources:

Expenditures:
1986-87 Nil
1987-88 $10,000

Funding:
1988-89 $330,000

Eligibility Criteria:

- Municipalities, the private sector and individuals
- Capital projects must be submitted through municipalities.
- Projects aimed at altering consumer behaviour to reduce waste generation.

Priority/Selection Criteria:

- Scope and effectiveness of project and potential for wider use
- Cost - benefit analysis

6) ENVIRONMENTAL SECURITY ACCOUNT

Goals/Objectives: To fund projects directed to the resolution of urgent health or environmental problems.

Timeframe: Annually funded

Activities Supported:

1) The Environmental Security account may be used in emergency situations and in cases of environmental problems to fund a clean-up or restore the natural environment, protect human health and safety and private alternative water supplies where an existing supply is at risk from contamination.

2) Projects must meet one or more of the following requirements to be eligible:

a) Hydrogeological studies of areas where serious contamination is known or expected;
b) Provision of alternative water supplies where existing supplies are affected or threatened by a source of contamination;
c) Cleanup of environmentally damaged areas or where health risks are identified.
d) Actions to remove or reduce potential long-term environmental hazards;

Funding Method: Up to 100% funding

- Expenditures are recovered from the polluting party whenever possible.

Resources: Expenditures:

1986-87	$17,094,067
1987-88	$27,927,000
1988-89	$12,762,753
1989-90	$17,402,104

Eligibility Criteria: Cleanup sites are recommended by the Ministry of the Environment regional offices, presumably, anyone would be eligible to propose cleanup sites to these offices.

Priority/Selection - Priority is based on risk to human health, the environment or actual environmental damage.
- Projects are not ranked according to relative priority.
- Selection criteria are those given as eligibility requirements under "Activities Supported".

Comments: This program is primarily aimed at the cleanup of spills or similar emergency situations.

7) GRANTS FOR ENVIRONMENTAL AND HEALTH PROTECTION RESEARCH

Goals/Objectives: To facilitate, through well-defined research projects, the solution of significant or urgent environmental problems and the amelioration of associated adverse human health effects.

Timeframe: Annually funded

Activities Supported: Research and Development

Funding Method: Grants
100% of projected costs including salary, travel, supplies, equipment and services.

Resources: Expenditures:

1986-87	$3,519,562
1987-88	$2,714,800

Funding:

1988-89	$2,500,000
1989-90	$5,000,000

Eligibility Criteria: Anyone is eligible to submit proposals for projects having a duration of 1 to 3 years.

Priority/Selection Criteria: Selections are based on a comprehensive technical evaluation of the research proposal, and on final recommendation by the Research Advisory Committee.

8) HOUSEHOLD SPECIAL WASTE COLLECTION GRANTS

Goals/Objectives: To divert hazardous waste generated by households from disposal in sanitary sewers and landfills, and to reduce the amount generated by households by increasing public awareness.

Timeframe: Annually funded

Activities Supported:

- The set-up and promotion of special waste days.
- Operational Costs: disbursements to a commercial waste management company; collection site rental; insurance; utilities; wages and benefits for municipal staff (if involved)
- Capital Costs: equipment expenditures or rental
- Promotion

Funding Method: Grants

- 50% of approved net costs up to a maximum of $5000 Total volume of paint and oil collected for a potential maximum grant of $15,000.
- Revenues from service charges, sale to recycling firms, or other grants are subtracted from approved net costs.

Resources:

Expenditures:

1986-87	$ 77,903
1987-88	$171,286
1988-89	$250,000

Funding:

1988-89	$250,000
1989-90	$250,000

Eligibility Criteria:

- This program is open to all municipalities in the province of Ontario.
- Within larger municipalities, each geographical location that serves distinctly different areas is eligible for funding.
- For each individual municipality or area, grants are available on an annual basis.

Priority/Selection Criteria:	Prioritized on basis of health and environmental concerns. Priority usually given to municipalities conducting a collection project for the first time.

9) ENVIRONMENTAL TECHNOLOGIES PROGRAM

Goals/Objectives: To encourage the development of new technologies that meet environmental and economic objectives in a mutually supportive fashion.

Timeframe: Annually

Activities Supported:

- Research, development, field trials and demonstration of innovative new technologies
- Supply and installation of equipment
- Chemical analyses and performance monitoring
- Technology transfer costs in support of the project, including publication
- Project audit costs, as requested by the MOE
- Other reasonable costs

Funding Method: Grants

- Project costs are shared with the applicant
- Government contributions to a maximum of 50% of the total project cost, except in special circumstances; example, two government agencies involved in funding a project in which case each could fund up to 1/3 of the cost.
- A maximum of $500,000 per year, for a total contribution of $1.5 million.
- Projects should not exceed three years.

Resources: Funding: $30 million over the next five years

Eligibility Criteria:

- Research and experimental development leading to the commercialization of products or processes
- Equipment-prototype development and testing
- Pilot-scale equipment refinement and adaptation
- Full-scale field trials and technical demonstrations of innovative technologies
- Initial demonstrations of existing technologies used outside Canada to determine their suitability in Ontario
- Projects demonstrating and applying the principles of sustainable development

Priority/Selection Criteria:

- Projects designed to lead to commercialization are preferred over projects that are strictly applied research.
- Technologies that prevent or reduce pollution at the source
- Technologies that assist municipalities and the private sector in meeting MISA, the Clean Air Program, and the Ontario Waste Management Abatement Strategy regulatory and policy requirements

10) METRO TORONTO WATERFRONT WATER QUALITY IMPROVEMENT PROGRAM (WWQIP)

Goals/Objectives: To address the pollution remedy needs of Metro Toronto.

Timeframe: Annually funded

Geographic Area Covered: Metro Toronto

Activities Supported:

- Technical Advice and Assistance: pollution control planning studies, monitoring and investigation
- Capital Costs: construction of remedial works, combined sewer overflow, storm sewer relief works, physical work on watercourses; the waterfront and sewer systems, including sewer separation.
- Operational Costs: tracing and disconnection of sewage cross connections (residential and industrial)

Funding Method: Grants

Resources:

Expenditures:

1986-87	$5,094,000
1987-88	$3,585,000

Funding:

1988-89	$4,683,000
1989-90	$2,812,000

Eligibility Criteria: The municipalities of Metro Toronto are eligible for funding under this program.

11) PESTICIDES RESEARCH PROJECTS

Goals/Objectives: The support of research on pesticides including:
1) Ways of reducing pesticide input into the environment
2) Minimizing risks from pesticides to the environment and human health
3) Enhancing the effectiveness of pest management and practices.

Timeframe: Annually funded

Activities Supported: Research pertaining to some aspect of pesticides.

Funding Method: Grants
A grant award (cheque) is paid to the research institute (to which the individual is affiliated) in advance of the initiation of the research, on 100% of the payment recommended by OPAC. Overhead is not paid according to current OPAC grant policy.

Resources:

	Expenditures:	Grants Awarded
1986-87	$387,317	33
1987-88	$399,850	31
1988-89	$400,000	29
1989-90	$400,000	29
Funding:		
1990-91	$400,000	20 to date

Eligibility Criteria: Anyone is eligible to submit proposals relating to the Ministry's research needs and this program's objectives.

Priority/Selection Criteria: Must meet annual funding goals; conditions of grant award must be met.

Criteria used in judging applicants:
1) applicability to research objectives
2) scientific quality of the research proposal
3) qualifications of the applicant(s)

Comments: A call for submission of research proposals is made in January with selection occurring February to March. Awards normally available at the start of the Ministries fiscal year (April-May). Later submissions maybe considered on the basis of funds remaining. Research may continue longer than one year but continuation are only supported if the report on previous years research is acceptable.

12) RURAL BEACHES PROGRAM

Goals/Objectives: The main objective is to improve rural water quality and minimize or eliminate rural beach placarding.

Timeframe: 1985-1995 (Annually funded)

Geographic Area Covered: 12 Conservation Authorities:

1. Ausable-Bayfield
2. Grand-River
3. Grey-Sauble
4. Lake Simcoe Region
5. Maitland Valley
6. Metro Toronto
7. Niagara Peninsula
8. Otonabee river
9. Upper Thames
10. Saugeen Valley
11. Essex Region
12. St. Clair

Activities Supported:

- Technical Advice and Assistance: water management studies
- Capital Costs: support projects recommended in the study

Funding Method: 100% grants for water management studies

Resources: Expenditures: 1986-87 $844,000
1987-88 $950,000

Funding: 1988-89 $500,000

Eligibility Criteria: There are 12 priority watersheds eligible for assistance under this program.

Comments: This program is predominantly funding studies in its initial phase. The second phase will involve capital support, however eligible costs still have not been decided upon.

13) URBAN BEACHES PROGRAM

Goals/Objectives: Development of new technology for the abatement of urban beach pollution.

Timeframe: Annually funded

Activities Supported: Technical Advice and Assistance: pollution control planning studies and pollutant source investigation.
Capital Cost:-facilities to treat/abate stormwater and combined sewer overflows;
- upgrade sewage treatment plants;
- innovative technology for beach protection and enhancement;
- sewer cross connection corrections.

Funding Method: Grants

Resources: PCP Funding 1987 - 88 $500,000
1988 - 89 $500,000

Eligibility Criteria: All Ontario urban municipalities

Comments: The Water Resources Branch administers the PCP studies aspect of this program while the capital support is administered by the Project Engineering Branch.

2.0 MINISTRY OF MUNICIPAL AFFAIRS

1) PROGRAM FOR RENEWAL, IMPROVEMENT, DEVELOPMENT AND ECONOMIC REVITALIZATION (PRIDE)

Goals/Objectives: Comprehensive community improvement

Timeframe: Annually funded

Activities Supported:

- Technical Advice and Assistance: aiding in the establishment of a community improvement plan
- Education
- Capital Costs: building, improving, replacing public services, utilities, facilities; land and building acquisition; aesthetic improvements
- Operational Costs: administration

Funding Method: Grants

- 50% of community improvement and land acquisition costs
- Grants must be matched by the municipality.
- Project must be completed within 4 years:
  - 1/3 must be spent by the end of year 2
  - 2/3 must be spent by the end of year 3

Resources: Funds Allocated

1987-88	$16,600,000.00
1988-89	$15,025,000.00
1989-90	$18,110,500.00

Eligibility Criteria:

- Only municipalities can apply for PRIDE assistance.
- Municipalities must:

1)have an official plan containing community improvement policies,
2)have a property maintenance and occupancy by-law in place; and
3) possess the financial and administrative capabilities to implement the policies.

Priority/Selection Criteria:

- Municipalities must be viewed as requiring improvement.
- Emphasis as on the degree to which the improvement will have a positive impact on the overall area and act as a catalyst for private sector investment.

Comments: For example, this program would be applicable in the upgrading of an area to promote tourism. Possibly an effective program for enlisting support from municipal authorities as part of a broader development initiative.

3.0 MINISTRY OF NATURAL RESOURCES

1) WETLANDS MANAGEMENT PROGRAM

Goals/Objectives: Conservation/Preservation of wetlands

Timeframe: Annually funded

Activities Supported: Operational costs:
- Property tax grants
- Wetland securing waterfowl habitat management
- Plan input and review

Funding Method: Grants
- Property tax grants for owners of wetland property of 100%
- Wetland-securing: funding agreement with Wildlife Habitat Canada and Ducks Unlimited Canada
- Waterfowl Habitat: funding agreement with above, plus Environment Canada
- Plan input and review

Resources:
- Approximately $1,000,000 was available in 1988 for securing wetlands. In 1989 and 1990 $250,000 will be matched with partnership funding from other organizations, to secure wetlands either through acquisition or stewardship agreements.

Eligibility Criteria:
- Wetland Securing: degree of threat by wetland class/value
- Conservation Land Act: all eligible owners of CI I-III wetlands may apply
- Waterfowl Habitat: waterfowl breeding/staying potential degree of threat

Priority/Selection Criteria:
- Habitat programs - selection by partners according to plans or agreement
- Tax rebate - no selection if landowner meets criteria

Comments:
- As the program is in transition (1989-90) further information on funding is currently unavailable

2) COMMUNITY FISHERIES INVOLVEMENT PROGRAMS (CFIP)

Goals/Objectives: To involve private citizens in the improvement of aquatic habitat in streams and lakes, mainly for fish species.

Timeframe: Ongoing

Activities Supported: Stream improvement, at spawning beds, bank riprap, bank shrubbery, deflectors, etc. Lake work such as creating shoals and stocking fish. Operating small fish hatcheries.

Funding Methods: Maximum of $8,000.00 granted to projects approved by district staff

Resources: Funds Allocated

Funding ($000's)

Year	Number of Projects	Project	Total
1982	24	49.1	121.0
1983	34	99.2	168.2
1984	122	500.9	450.9
1985	138	269.9	298.1
1986	191	476.4	526.6
1987	215	529.8	530.8
1988	230	433.1	522.6

Eligibility Criteria: Project must fit in with the District Fish Management Plan

Priority/Selection Criteria: Must directly assist the local fish resource

Comments: A widely successful program that is highly respected by the public and that is still growing.

4.0 FEDERAL-PROVINCIAL FUNDING AGREEMENTS

Federal/provincial agreements have been negotiated over the years with Ontario to deal with a whole range of water quality issues that have emerged. Existing federal-provincial agreements which contribute to many provincial programs pertaining to the Great Lakes Remedial Action Plans are described in this section. Programs directly administered by the federal government are also included in this section.

Name of Agreement: **CANADA - ONTARIO AGREEMENT ON GREAT LAKES WATER QUALITY**

TimeFrame: August 1971 to March 31, 1991: agreement renewed in 1976, 1982, and 1986.

Purpose: To renew and strengthen cooperation between Canada and Ontario in meeting the obligations under the revised 1978 Canada - U.S. Agreement; to provide for cost-sharing of specific programs which the province will undertake with the federal government in meeting these obligations; to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem through a maximum effort to develop a better understanding of the ecosystem and to eliminate or reduce to the maximum extent possible the discharge of pollutants into the Great Lakes system.

Financing and Operation: The renewed agreement provides $82.1 million for surveillance, upgraded sewage treatment, and phosphorous control programs. Each of the governments will contribute $9.6 million for surveillance to determine concentrations of pollutants in the Great Lakes. In addition, each will give $1.4 million to a new program to control phosphorous. Special funding in the amount of $65 million was made available to Ontario for the period 1982-1985 to assist in the completion of municipal sewage facilities construction to meet the requirements of the Canada-U.S. agreement. This extra funding was formalized under the 1982 Canada-Ontario Agreement. Some $9.7 million of the original funds were not expended, and this amount was committed under the 1986 renewal agreement. Ontario and area municipalities will contribute an additional $50.4 million to upgrade present sewage treatment facilities or build new ones.

The departments involved are Environment, Fisheries and Oceans, Health and Welfare, Transport, Public Works, and Agriculture.

Name of Agreement: **CANADA - ONTARIO WILDLIFE CONSERVATION AGREEMENT**

Timeframe: February 3, 1984 through March 31, 1993/

Purpose: To coordinate the implementation of joint programs and policies for the conservation of wildlife and the provision of wildlife-related benefits to Canadians.

Financing and Operation: The agreement will be administered by a committee consisting of three representatives of each party. One member shall be the Regional Director, Canadian Wildlife Service, Ontario Region (Canada) and another shall be the Director of the Wildlife Branch, Ontario Ministry of Natural Resources.

Payments: The contributions of either party shall not exceed $1,000,000 in any year, and in any event, neither party shall contribute more than nine-tenths of the costs in any given year. COntributions by Canada are subject to approval by Treasury Board and those of Ontario are subject to allocation of funds by the Provincial Management Board of Canada.

Name of Agreement: **CANADA - ONTARIO FISHERIES AGREEMENT**

Timeframe: The agreement took effect July 1, 1988, and continues thereafter until terminated or until one year after one party notifies the other of its intention to terminate.

Purpose: To renew and strengthen cooperation between Canada and Ontario to achieve the goals as stated in the strategic plan for Ontario fisheries, and to ensure that cooperative action is taken, within the national framework, in pursuing the objectives of this plan.

Authority: The Fisheries Act, RSC 1970, F-14

Name of Agreement: **CANADA-ONTARIO AGREEMENT ON SOUTHWESTERN ONTARIO SOIL AND WATER QUALITY ENHANCEMENT**

Administered By: Agriculture Canada, Environment Canada, Ontario Ministry of Agriculture and Food and the Ontario Ministry of the Environment.

Purpose: There are two objectives of this Agreement: to reduce phosphorous loading to the Lake Erie Basin from non-point agricultural cropland sources, and to maintain or improve the productivity of the primary agricultural sector in southwestern Ontario by reducing or arresting soil erosion and degradation.

Authority/Background: Department of Agriculture Act.

Time Frame: The Agreement will be in effect from April, 1985 until March 1993. Projects approved to March 31, 1992 may be completed and their costs paid for after that date, but no costs shall be paid in relation to any project after March 31, 1993.

Financing and Operation: The Government of Ontario and the Government of Canada will contribute $15 million each to programs included in this agreement. Canada and Ontario, through their departments of agriculture, will administer programs related to soil and water quality enhancement, and will assume full responsibility for monitoring, evaluating and reporting the impact of various agricultural practices on water quality.

5.0 FEDERAL PROGRAMS

In 1989, the federal government announced it would spend $125 Million on clean-up in the Great Lakes area over five years, under the Great Lakes Action Plan. The money will help clean up and maintain water quality as well as prevent future pollution of the lakes. Elements of the plan include the following programs:

Name of Program: GREAT LAKES CLEANUP FUND

Purpose: Established in 1990, this fund is providing money to ensure the clean up of pollution sources within federal jurisdiction in the 17 Canadian Areas of Concern.

Funding eligibility: Initiatives funded under this program include:
- addressing the problem of contaminated sediments in federal harbours;
- dealing with historic wastes on federally-controlled lands;
- testing new clean-up techniques and technologies in programs with other government department sectors.

Financing: $55 million over 5 years as follows:

- 1990/91	$5 M
- 1991/92	$8 M
- 1992/93	$10 M
- 1993/94	$32 M

Name of Program: GREAT LAKES PRESERVATION PROGRAM

Purpose: This program brings together the scientific and technological expertise of the federal departments of Environment, Fisheries and Oceans, Agriculture, Transport and Public Works to address Great Lakes pollution.

Financing: $50 million over the next 5 years, starting in 1990.

Name of Program: ST. LAWRENCE ACTION PLAN

Purpose: This program is designed to reduce industrial pollution, by reducing by 90% the toxic liquid discharges into the river from 50 industrial sites considered to be the biggest polluters.

Financing: $110 million over the next 5 years, starting in 1990.

In addition, the Federal government announced in June, 1989 that it would establish the following three-year program:

Name of Program: ENVIRONMENTAL PARTNERS FUND PROGRAM (EXPIRES MARCH 1994)

Purpose: This program is a Government of Canada initiative which is designed to help local groups take action in protecting, preserving, enhancing and restoring the environment at the community level.

Funding Eligibility: Innovative, action-oriented projects, that protect, preserve, improve and restore the environment in the community are eligible.

Only non-governmental, non-commercial groups are eligible to apply, such as:
- service clubs
- voluntary organizations
- environmental non-profit and youth groups
- trade associations and trade union organizations

Projects that are required by law or regulation or are the responsibility of federal and other levels of government are not eligible. Also not eligible are educational activities, training programs, research activities, purchase of real property, or recreation and beautification projects.

Financing: The federal contribution, up to 50% of the total approved project cost, could be as much as $200,000 over three consecutive years. Volunteer time can count as part of a groups's contribution to a project.

Funding to Date: $14.2 million approved for 365 projects with a total project value of $65 million.

ANNEX C: COST ESTIMATIONS - BASIC ASSUMPTIONS

ANNEX C: COST ESTIMATIONS - BASIC ASSUMPTIONS

1. Catchment Hydraulics:

   Per Storm
   Assume 5 mm runoff or CSO's to be contained.
   For 1 ha obtain

   Per Season

   20 Events @
   Per Year

2. Storage Costs:

Tanks	$\$500/m^3 \times 50\ m^3/ha =$	\$25,000/ha
Ponds (Wet)	$\$\ 50/m^3 \times 50\ m^3/ha =$	\$ 2,500/ha
Ponds (Dry)	$\$\ 25/m^3 \times 50\ m^3/ha =$	\$ 1,250/ha

3. Sewer Separation Costs =\$161,718/ha

4. Treatment Costs:

Screens	$\$5\text{-}\$25/m^3/d$
Swirls	$\$10\text{-}\$25/m^3/d$
Flobal	$\$150\text{-}\$225/m^3$
Nets	$\$.15\text{-}\$.50/m^3/d$

   Assume catch 5 mm and treat in 2 days,
   Obtain 25 $m^3/d/ha$ ($2.9 \times 10^{-4}\ m^3/s/ha$)
   Screens and Swirl and Disinfect say $\$100/m^3/d = \$2,500/m^3/d/ha$

5. Overall Urban Runoff Control Costs, including capital costs and program costs (ie education, environmental, studies, etc.), use;

   For Combined Systems \$50,000/ha
   For Storm Systems \$25,000/ha

ANNEX D: RAP QUESTIONNAIRE

d) What criteria are you using or do you intend to use to prioritize the activities in your RAP site?

e) What form of cost effectiveness analysis have you applied or will you apply to evaluate your remedial options?

f) What is your definition of cost effective?

g) What information would assist you in conducting cost-effectiveness analysis?

h) How do you expect to apply the results of this study?

Thank you for your response. If you have any questions, call Trish Johnson Cover at (613) 226-1844. Please return by fax to R.V. Anderson Associates fax number (613) 226-8930 by Thursday, May 2, 1991.

ANNEX E: COMPLETE BIBLIOGRAPHYY

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ANNEX F: A LIST OF DATA SOURCES FOR THE CASE STUDIES

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The following is a list of data sources for the case studies with a short explanation of the type of data used:

Brooks, D. B., Peters, R. and Robillard, P, "Pricing - A Neglected Tool For Managing Water Demand", Policy Alternatives, 1990, pp. 40-48 (price elasticities).

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Ministry of Community and Social Services, FBA (recipient average household income).

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Statistics Canada Catalogue 31-209, Manufacturing Establishments (# of manufacturing establishments).

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